Sepam™ Series 80 Protective Relays

Installation Manual

Instruction Bulletin

63230-216-229-B1

Retain for future use.

Merlin Gerin
Square D
Telemecanique

Schneider Electric

Safety Instructions

Safety Symbols and Messages

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

ANSI symbol

IEC symbol

Risk of Electric Shock

The addition of either symbol to a “Danger” or “Warning” safety label on a device indicates that an electrical hazard exists, which will result in death or personal injury if the instructions are not followed.

Safety Alert

This is the safety alert symbol. It is used to alert you to potential personal injury hazards and prompt you to consult the manual. Obey all safety instructions that follow this symbol in the manual to avoid possible injury or death.

Safety Messages

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or property damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **could result in** death, serious injury or property damage.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, minor or moderate injury or property damage.

Important Notes

Restricted Liability

Electrical equipment should be serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this manual. This document is not intended as an instruction manual for untrained persons.

Device Operation

The user is responsible for checking that the rated characteristics of the device are suitable for its application. The user is responsible for reading and following the device’s operating and installation instructions before attempting to commission or maintain it. Failure to follow these instructions can affect device operation and constitute a hazard for people and property.

Protective Grounding

The user is responsible for compliance with all the existing international and national electrical codes concerning protective grounding of any device.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

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Safety Instructions
Before You Begin

Carefully observe these safety instructions before installing, repairing, servicing, or maintaining electrical equipment.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. In the USA, see NFPA 70E.
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance of this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Turn off all power supplying the power meter and the equipment in which it is installed before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Before closing all covers and doors, carefully inspect the work area for tools and objects that may have been left inside the equipment.
- Use caution while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which could cause personal injury.
- Successful equipment operation requires proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- NEVER bypass external fusing.
- NEVER short the secondary of a Power Transformer (PT).
- NEVER open circuit a Current Transformer (CT); use the shorting block to short circuit the leads of the CT before remooving the connection from the power meter.
- Before performing Dielectric (Hi-Pot) or Megger testing on any equipment in which the power meter is installed, disconnect all input and output wires to the power meter. High voltage testing may damage electronic components contained in the power meter.
- The power meter should be installed in a suitable electrical enclosure.

Failure to follow these instructions will result in death or serious injury.

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The Sepam™ range of protection relays is designed for operating machines, the electrical distribution networks of industrial installations, and utility substations at all levels of voltage. The Sepam™ family includes:

- *Sepam™ Series 20*
- *Sepam™ Series 40*
- *Sepam™ Series 80*

to cover all needs, from the simplest to the most complete.

PE50278

Sepam™ Series 80 with integrated advanced UMI

Note : *For technical support, contact (615) 287-3400 or go to www.powerlogic.com*

Sepam™ Series 80: Intelligent Solutions for Custom Applications

Specially designed for demanding customers on large industrial sites, Sepam™ Series 80 provides proven solutions for electrical distribution and machine protection

Main Characteristics

The Sepam™ Series 80 offers these features:

- protects closed ring networks or networks with parallel mains by means of directional protection and logic discrimination
- directional ground fault protection for impedance-grounded and isolated or compensated neutral systems
- complete protection of transformers and machine-transformer units
  - stable, sensitive differential protection with neural network restraint
  - linked to all necessary backup protection functions
- complete protection of motors and generators
  - against internal faults:
    - stable, sensitive machine differential protection, with starting and sensor loss restraint
    - field loss, stator ground fault
  - against network and process faults: pole slip, speed control, inadvertent energization
- sync-check between two networks before tie breaker
- measurement of harmonic distortion, current and voltage, to assess network power quality
- 42 inputs / 23 outputs for comprehensive equipment control
- mimic-based UMI for local switchgear control
- SFT2841 parameter setting and operating software, a simple and complete tool that is indispensable for all Sepam™ users:
  - assisted preparation of parameter and protection settings
  - complete information during commissioning
  - remote equipment management and diagnostics during operation
- logic equation editor built into the SFT2841 software to adapt the predefined control functions
- optional SFT2885 programming software (Logipam), to program specific control and monitoring functions
- two communication ports to integrate Sepam™ in two different networks or redundant architectures
- removable memory cartridge to get equipment in operation again quickly after the replacement of a faulty base unit
- battery backup to save historical and disturbance recording data

Selection Guide

The Sepam™ Series 80 family includes 16 types to offer the right solution for each application.

Specific Protection Functions Available	Applications					
	Substation	**Transformer**	**Motor**	**Generator**	**Bus**	**Capacitor**
Non-directional phase and ground faults	S80				B80	
Directional ground fault	S81	T81	M81			
Directional ground fault and phase overcurrent	S82	T82		G82		
Check on 3-phase voltages on two sets of buss					B83	
Rate of change of frequency	S84					
Capacitor bank unbalance						C86
Transformer or machine differential		T87	M87	G87		
Machine-transformer unit differential			M88	G88		

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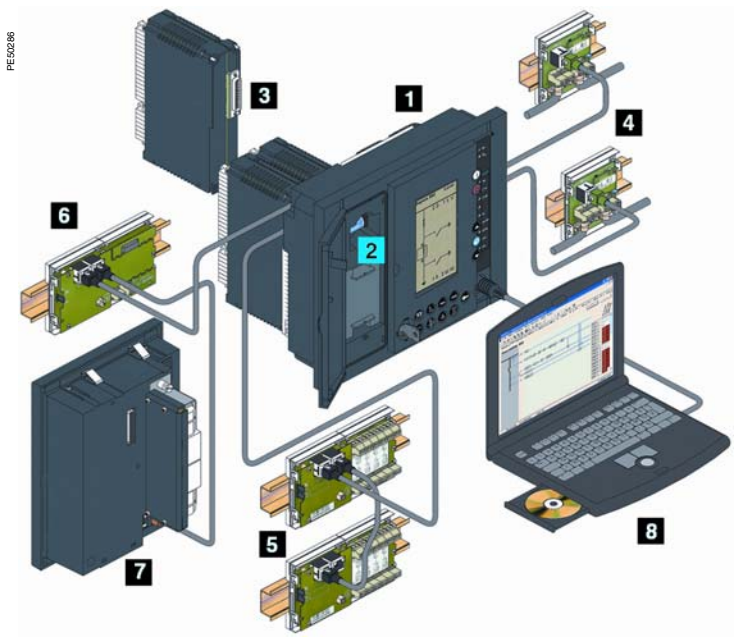
Introduction
Modular Architecture

Flexibility and Upgrading Capability

The user can add optional modules to Sepam™ at any time for increased functionality. This gives Sepam™ exceptional versatility, adapting to as many situations as possible, and allowing for future installation upgrade,



1 **Base unit, with different types of User Machine Interfaces (UMI):**
- integrated mimic-based UMI
- integrated or remote advanced UMI

2 **Parameter and protection settings saved on removable memory cartridge.**

3 **42 logic inputs and 23 output relays**
with three optional modules providing 14 inputs and 6 outputs.

4 **Two independent communication ports**
- direct connection to 2-wire RS485, 4-wire RS 485 and fiber optic networks
- connection to Ethernet TCP/IP network via PowerLogic Ethernet server (Transparent Ready™)

5 **Processing of data from 16 temperature sensors,**
Pt100, Ni100, or Ni120.

6 **1 low level analog output,**
0-10 mA, 4-20 mA or 0-20 mA

7 **Sync-check module**

8 **Software tools:**
- Sepam™ parameter and protection setting, and predefined control functions adaptation
- local or remote installation operation
- programming specific functions (Logipam)
- retrieval and display of disturbance recording data

Easy Installation

- light, compact base unit
- easy to integrate due to Sepam's adaptation capabilities:
  - universal supply voltage and logic inputs: 24 to 250 V DC
  - phase currents may be measured by 1A or 5A current transformers, or LPCT (Low Power Current Transducer) type sensors
  - residual current calculated or measured by a choice of methods to fit requirements
- the same, easy-to-install remote modules for all Sepam™ units:
  - mounted on DIN rail
  - connected to the Sepam™ base unit by prefabricated cables

Commissioning Assistance

- predefined functions implemented by simple parameter setting
- user-friendly, powerful SFT2841 PC setting software tool used on all Sepam™ units to provide users with all the possibilities offered by Sepam™.

Intuitive Use

- integrated or remote advanced User Machine Interface (UMI) installed in the most convenient place for the facility manager
- integrated mimic-based User Machine Interface for local control of switchgear
- user-friendly User Machine Interface, with direct access to data
- clear graphic LCD display of all data required for local operation and installation diagnosis
- working language may be customized to be understood by all users

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Introduction
Selection Table

		Substation				Transformer			Motor			Generator			Bus		Cap.
Protection	**ANSI Code**	**S80**	**S81**	**S82**	**S84**	**T81**	**T82**	**T87**	**M81**	**M87**	**M88**	**G82**	**G87**	**G88**	**B80**	**B83**	**C86**
Phase overcurrent (1)	50/51	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Ground fault / Sensitive ground fault (1)	50N/51N 50G/51G	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Breaker failure	50BF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Negative sequence / unbalance	46	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Thermal overload for cables	49RMS		2	2	2												
Thermal overload for machines (1)	49RMS					2	2	2	2	2	2	2	2	2			
Thermal overload for capacitors	49RMS																2
Capacitor bank unbalance	51C																8
Restricted ground fault	64REF					2	2	2				2		2			
Two-winding transformer differential	87T							1			1			1			
Machine differential	87M									1			1				
Directional phase overcurrent (1)	67			2	2		2	2				2	2	2			
Directional ground fault (1)	67N/67NC		2	2	2	2	2	2	2	2	2	2	2	2			
Directional active overpower	32P		2	2	2	2	2	2	2	2	2	2	2	2			
Directional reactive overpower	32Q								1	1	1	1	1	1			
Directional active underpower	37P				2							2					
Phase undercurrent	37								1	1	1						
Excessive starting time, locked rotor	48/51LR								1	1	1						
Starts per hour	66								1	1	1						
Field loss (underimpedance)	40								1	1	1	1	1	1			
Pole slip	78PS								1	1	1	1	1	1			
Overspeed (2 set points) (2)	12								□	□	□	□	□	□			
Underspeed (2 set points) (2)	14								□	□	□	□	□	□			
Voltage-restrained overcurrent	50V/51V											2	2	2			
Underimpedance	21B											1	1	1			
Inadvertent energization	50/27											1	1	1			
Third harmonic undervoltage / 100 % stator ground fault	27TN/64G2 64G											2	2	2			
Overfluxing (V / Hz)	24							2				2	2	2			
Positive sequence undervoltage	27D	2	2	2	4	2	2	2	2	2	2	2	2	2	4	4	4
Remanent undervoltage	27R	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Undervoltage (L-L or L-n)	27	4	4	4	2	4	4	4	4	4	4	4	4	4	2	2	2
Overvoltage (L-L or L-n)	59	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Neutral voltage displacement	59N	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Negative sequence overvoltage	47	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overfrequency	81H	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Underfrequency	81L	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Rate of change of frequency	81R				2												
Recloser (4 shots) (2)	79	□	□	□	□												
Thermostat / Sudden pressure (2)	26/63					□	□	□	□		□	□		□			
Temperature monitoring (16 RTDs) (3)	38/49T					□	□	□	□	□	□	□	□	□			□
Sync-check (4)	25	□	□	□	□	□	□	□				□	□	□	□	□	
Control and Monitoring																	
Circuit breaker / contactor control	94/69	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Automatic transfer (AT) (2)		□	□	□	□	□	□	□				□	□	□	□	□	
Load shedding / automatic restart									■	■	■						
De-excitation	41											■	■	■			
Genset shutdown												■	■	■			
Capacitor step control (2)																	□
Logic discrimination (2)	68	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Latching / acknowledgement	86	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Annunciation	30	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Switching of groups of settings		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Adaptation using logic equations		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Logipam programming (Ladder language)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

The figures indicate the number of relays available for each protection function.
■ *standard,* □ *options.*
(1) *Protection functions with two groups of settings.*
(2) *According to parameter setting and optional MES120 input/output modules.*
(3) *With optional MET1482 temperature input modules.*
(4) *With optional MCS025 sync-check module.*

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Introduction
Selection Table

		Substation				Transformer			Motor			Generator			Bus		Cap.
Metering		**S80**	**S81**	**S82**	**S84**	**T81**	**T82**	**T87**	**M81**	**M87**	**M88**	**G82**	**G87**	**G88**	**B80**	**B83**	**C86**
Phase current Ia, Ib, Ic RMS		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measured residual current Ir, calculated IrΣ		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Demand current Ia, Ib, Ic		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Peak demand current Iamax, Ibmax, Icmax		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measured residual current I'r		■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Voltage Vab, Vbc, Vca, Van, Vbn, Vcn		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Residual voltage Vr		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Positive sequence voltage V1 / rotation direction		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Negative sequence voltage V2		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Frequency f		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Active power P, Pa, Pb, Pc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Reactive power Q, Qa, Qb, Qc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Apparent power S, Sa, Sb, Sc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Peak demand power Pmax, Qmax		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Power factor pf		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Calculated active and reactive energy (±Wh, ±VARh)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Active and reactive energy by pulse counting (2) (± Wh, ± VARh)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Phase current I'a, I'b, I'c RMS								■		■	■		■	■			
Calculated residual current I'rΣ								■		■	■		■	■			
Voltage V'ab, V'an and frequency															■		
Voltage V'ab, V'bc, V'ca, V'an, V'bn, V'cn, V'1, V'2, and frequency																■	
Residual voltage V'r																■	
Temperature (16 RTDs) (3)						□	□	□	□	□	□	□	□	□			□
Rotation speed (2)									□	□	□	□	□	□			
Neutral point voltage Vnt									■	■	■	■	■	■			
Network and Machine Diagnosis																	
Tripping context		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Tripping current TripIa, TripIb, TripIc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase fault and ground fault trip counters		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Unbalance ratio / negative sequence current I2		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Harmonic distortion (thD), current (Ithd), and voltage (Vthd)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase displacement φr, φ'r, φrΣ		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase displacement φa, φb, φc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Disturbance recording		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Thermal capacity used			■	■	■	■	■	■	■	■	■	■	■	■			■
Remaining operating time before overload tripping			■	■	■	■	■	■	■	■	■	■	■	■			■
Waiting time after overload tripping			■	■	■	■	■	■	■	■	■	■	■	■			■
Running hours counter / operating time						■	■	■	■	■	■	■	■	■			■
Starting current and time									■	■	■						
Start block time									■	■	■						
Number of starts before blocking									■	■	■						
Unbalance ratio / negative sequence current I'2								■		■	■		■	■			
Differential current Idiffa, Idiffb, Idiffc								■		■	■		■	■			
Through current Ita, Itb, Itc								■		■	■		■	■			
Current phase displacement θ								■		■	■		■	■			
Apparent positive sequence impedance Z1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Apparent phase-to-phase impedances Zab Zbc, Zac			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Third harmonic voltage, neutral point (VntH3) or residual (VrH3)												■	■	■			
Difference in amplitude, frequency and phase of voltages compared for sync-check (4)		□	□	□	□	□	□	□				□	□	□	□	□	
Capacitor unbalance current and capacitance																	■
Switchgear Diagnosis	**ANSI Code**																
CT / VT supervision	60/60FL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Trip circuit supervision (2)	74	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Auxiliary power supply monitoring	27DC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Cumulative breaking current		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Number of operations, operating time, charging time, number of racking out operations (2)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Modbus, IEC 60870-5-103 or DNP3 Communication																	
Measurement readout (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote indication and time tagging of events (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote control commands (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote protection setting (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Transfer of disturbance recording data (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

■ *standard,* □ *options.*

(2) *According to parameter setting and optional MES120 input/output modules.*

(3) *With optional MET1482 temperature input modules.*

(4) *With optional MCS025 sync-check module.*

(5) *With ACE9492, ACE959, ACE937, ACE969TP or ACE969FO communication interface.*

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Weight					
		Base Unit with Advanced UMI		**Base Unit with Mimic-Based UMI**	
Minimum weight (base unit without MES120 I/O module)		5.29 lb (2.4 kg)		6.61 lb (3.0 kg)	
Maximum weight (base unit with 3 MES120 I/O modules)		8.82 lb (4.0 kg)		10.1 lb (4.6 kg)	
Sensor Inputs					
Phase Current Inputs		**1A or 5A CT**			
Input impedance		< 0.02 Ω			
Burden		< 0.02 VA (1 A CT) < 0.5 VA (5 A CT)			
Continuous thermal withstand		4 I_N (1)			
1 second overload		100 I_N (1)			
Voltage Inputs		**Phase**		**Residual**	
Input impedance		> 100 kΩ		> 100 kΩ	
Burden		< 0.015 VA (100 V VT)		< 0.015 VA (100 V VT)	
Continuous thermal withstand		240 V		240 V	
1-second overload		480 V		480 V	
Isolation of inputs from other isolated groups		Enhanced		Enhanced	
Relay Outputs					
Control Relay Outputs O1 to O4 and Ox01 (2)					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		8 A	8 A	8 A	8 A
Breaking capacity	Resistive load	8 A / 4 A	0.7 A	0.3 A	
	Load L/R < 20	6 A / 2 A	0.5 A	0.2 A	
	Load L/R < 40 ms	4 A / 1 A	0.2 A	0.1 A	
	Resistive load				8 A
	Load p.f. > 0.3				5 A
Making capacity		30 A for 200 ms(2)			
Isolation of outputs from other isolated groups		Enhanced			
Annunciation Relay Output O5 and Ox02 to Ox06					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		2 A	2 A	2 A	2 A
Breaking capacity	Load L/R < 20 ms	2 A / 1 A	0.5 A	0.15 A	
	Load p.f. > 0.3				1 A
Isolation of outputs from other isolated groups		Enhanced			
Power Supply					
Voltage		24 to 250 V DC	–20 % / +10 %		
Maximum burden		< 16 W			
Inrush current		< 10 A 10 ms			
Acceptable ripple content		12 %			
Acceptable momentary outages		100 ms			
Battery					
Format		1/2 AA lithium 3.6 V			
Service life		10 years, if Sepam™ is energized			
		8 years, if Sepam™ is not energized			

***(1) I_N** = primary CT rating*
***(2)** Relay outputs complying with clause 6.7 of ANSI standard C37.90 (30 A, 200 ms, 2000 operations).*

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Introduction
Environmental Characteristics

Electromagnetic Compatibility	Standard	Level / Class	Value
Emission Tests			
Disturbing field emission	IEC 60255-25		
	EN 55022	A	
Conducted disturbance emission	IEC 60255-25		
	EN 55022	A	
Immunity Tests – Radiated Disturbances			
Immunity to radiated fields	ANSI C37.90.2 (1995)		35 V/m; 25 MHz - 1 GHz
	IEC 60255-22-3		10 V/m; 80 MHz - 1 GHz
	IEC 61000-4-3	III	10 V/m; 80 MHz - 2 GHz
Electrostatic discharge	ANSI C37.90.3		8 kV air; 4 kV contact
	IEC 60255-22-2		8 kV air; 6kV contact
Immunity to magnetic fields at network frequency	IEC 61000-4-8	4	30 A/m (continuous) - 300 A/m (1 - 3 s)
Immunity Tests – Conducted Disturbances			
Immunity to conducted RF disturbances	IEC 60255-22-6	III	10 V
Fast transient bursts	ANSI C37.90.1		4 kV; 2.5 kHz
	IEC 60255-22-7	A and B	4 kV; 2.5 kHz / 2 kV; 5 kHz
	IEC 61000-4-4	IV	4 kV; 2,5 kHz
1 MHz damped oscillating wave	ANSI C37.90.1		2.5 kV; 2.5 kHz
	IEC 60255-22-1		2.5 kV CM; 1 kV DM
Surges	IEC 61000-4-5	III	2 kV CM; 1 kV DM
Voltage interruptions	IEC 60255-11		100 % during 100 ms
Hardware Parameters	**Standard**	**Level / Class**	**Value**
In Operation			
Vibrations	IEC 60255-21-1	2	1 Gn; 10 Hz - 150 Hz
	IEC 60068-2-6	Fc	2 Hz - 13.2 Hz ; a = ±1 mm
Shocks	IEC 60255-21-2	2	10 Gn / 11 ms
Earthquakes	IEC 60255-21-3	2	2 Gn (horizontal axes)
			1 Gn (vertical axes)
De-Energized			
Vibrations	IEC 60255-21-1	2	2 Gn; 10 Hz - 150 Hz
Shocks	IEC 60255-21-2	2	27 Gn / 11 ms
Jolts	IEC 60255-21-2	2	20 Gn / 16 ms
Climate Variables	**Standard**	**Level / Class**	**Value**
In Operation			
Exposure to cold	IEC 60068-2-1	Ad	–25°C (–13°F)
Exposure to dry heat	IEC 60068-2-2	Bd	+70°C (+158°F)
Continuous exposure to damp heat	IEC 60068-2-78	Cab	10 days; 93 % RH; 40°C (104°F)
Salt mist	IEC 60068-2-52	Kb/2	6 days
Influence of corrosion/2-gas test	IEC 60068-2-60		21 days; 75 % RH; 25°C (77°F); 0.5 ppm H_2S; 1 ppm SO_2
Influence of corrosion/4-gas test	IEC 60068-2-60		21 days; 75 % RH; 25°C (77°F); 0.01 ppm H_2S; 0.2 ppm SO_2; 0.2 ppm NO_2; 0.01 ppm Cl_2
In Storage (1)			
Temperature variation with specified variation rate	IEC 60068-2-14	Nb	–25°C to +70°C (–13°F to +158°F); 5°C/min
Exposure to cold	IEC 60068-2-1	Ab	–25°C (–13°F)
Exposure to dry heat	IEC 60068-2-2	Bb	+70°C (+158°F)
Continuous exposure to damp heat	IEC 60068-2-78	Cab	56 days; 93 % RH; 40°C (104°F)
	IEC 60068-2-30	Db	6 days; 95 % RH; 55°C (131°F)
Safety	**Standard**	**Level / Class**	**Value**
Enclosure Safety Tests			
Front panel tightness	IEC 60529	IP52	Other panels IP20
	NEMA	Type 12	
Fire withstand	IEC 60695-2-11		650°C (1200°F) with glow wire
Electrical Safety Tests			
1.2/50 µs impulse wave	IEC 60255-5		5 kV (2)
Power frequency dielectric withstand	ANSI C37.90		1 kV 1 min (indication output) 1.5 kV 1 min (control output)
	IEC 60255-5		2 kV 1 min (3)
Certification		**European Directives:**	
CE	EN 50263 harmonized standard	89/336/EEC Electromagnetic Compatibility (EMC) Directive ■ 92/31/EEC Amendment ■ 93/68/EEC Amendment 73/23/EEC Low Voltage Directive ■ 93/68/EEC Amendment	
UL	UL508 - CSA C22.2 no. 14-95		File E212533
CSA	CSA C22.2 no. 14-95 / no. 94-M91 / no. 0.17-00		File 210625

(1) *Sepam™ must be stored in its original packing.*
(2) *Except for communication: 3 kV in common mode and 1 kV in differential mode.*
(3) *Except for communication: 1 kVrms.*

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Introduction
Precautions

Follow the instructions in this document for proper installation of your Sepam™ unit:

- *Equipment identification*
- *Assembly*
- *Connecting current, voltage, and sensor inputs*
- *Power supply connection*
- *Checking prior to commissioning*

Handling, Transport, and Storage

Sepam™ in its Original Packaging

Transport:
Sepam™ can be shipped to any destination by all usual means of transport without taking any additional precautions.

Handling:
Normal handling procedures apply to Sepam™. Under normal care Sepam™ can withstand being dropped by a person standing at floor-level.

Storage:
You can store Sepam™ in its original packaging in an appropriate location (preferably a cool, dry environment) for several years. Keep the original packaging as long as possible. Sepam™, like all electronic units, cannot be stored in damp environments for more than a month. Storage characteristics are as follows:

- Temperature from –25°C to +70°C (–13°F to +158°F)
- Humidity ≤ 90%.

Annual periodic inspections of the environment and equipment are recommended. Sepam™ should be placed into service as soon as possible after it has been unpacked.

Sepam™ Installed in a Cubicle

Transport:
Transport Sepam™ by normal means. Monitor storage conditions for long periods of transport.

Handling:
Visually inspect for damage and test Sepam™ if the unit is dropped.

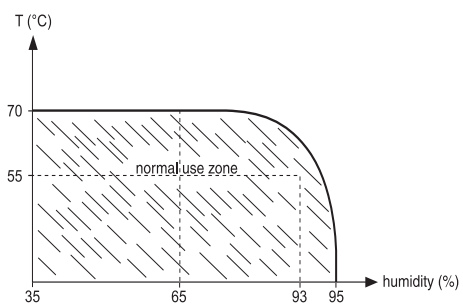
Storage:
Store Sepam™ in a cool, dry environment. If damp conditions exist, place it into service and energize as soon as possible. If this is not possible, cubicle storage conditions must be modified.

Environment of the Installed Sepam™

Operation in a Damp Environment
Temperature and relative humidity factors must be compatible with the unit's environmental operating and storage characteristics. If conditions for use fall outside the normal operating range of the equipment, make all special arrangements necessary to manage and control Sepam™'s operating environment prior to commissioning.

Operation in a Contaminated Atmosphere
A contaminated industrial atmosphere (such as the presence of chlorine, hydrofluoric acid, sulfur, solvents) can corrode electronic components. Sepam™ is certified Level C according to IEC 60068-2-60 standard under the following test conditions:

- 2-gas test: 21 days, 25°C (77°F), 75% relative humidity, 0.5 ppm H_2S, 1 ppm SO_2
- 4-gas test: 21 days, 25°C (77°F), 75% relative humidity, 0.01 ppm H_2S, 0.2 ppm SO_2, 0.2 ppm NO_2, 0.01 ppm Cl_2



Environmental control arrangements should be made (such as pressurized premises with filtered air, etc.) as necessary before commissioning.

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Equipment Identification

Package Contents

The following items are packaged separately with each Sepam™:

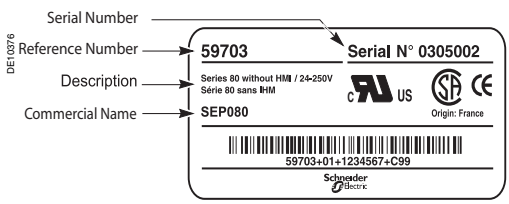
- One Sepam™ Series 80 base unit, with memory cartridge and two connectors Ⓐ and Ⓔ tightened
- One or two CCA 630s (or CCA634s) for CTs
  - or CCA671 for LPCTs
  - OR CCT640 for extra VTs
- Two 20-point ring lug type terminal blocks (CCA620) for control power, ground sensor input, and four main unit outputs
- One battery
- Eight spring clips
- One terminal block identification label
- Instruction materials (see below)

Optional accessories such as modules, current input connectors, and cables are delivered in separate packages.

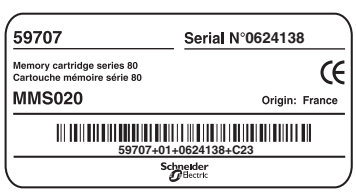
Note : *Sepam™ SFT2841 software ships separately, even if it is ordered at the same time.*

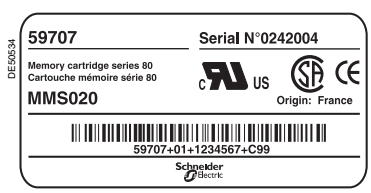
Identification of the Base Unit

To identify a Sepam™, inspect the three labels located behind the front door of the panel board. A base unit hardware label is on the back of the door.



The two labels below are mounted on the cartridge:



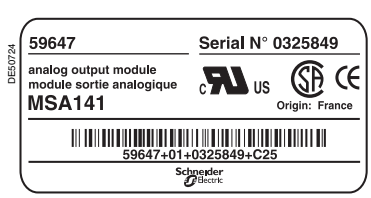


Cartridge hardware reference label

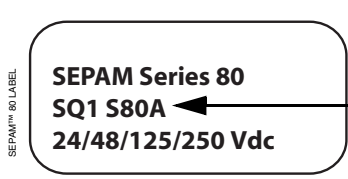
The software reference label identifies the specific application and working language.

Accessory Identification

Accessories — such as optional modules, current or voltage connectors and connection cables — come in separate packages and are identified by labels.



MSA141 Module Identification Label Example



Label for units sold in US

A 4-alpha suffix denotes a deviation from one or more of these standard features:

- Second language = US English*
- Connection for current input
- Terminal blocks for A and E for ring lugs (see diagram on page 16)

For example, SQM87A-UFLR has one LPCT connector

Note : *The second language will be US English; the default language will be UK English*

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Instruction Materials

Your Sepam™ Series 80 base unit is shipped with the following instruction documents:

- *Sepam™ Series 80: Installation, Use, Commissioning and Maintenance Manual* (this bulletin), reference number 63230-216-229 (for North American users)
- *Sepam™ Series 80: Quick Start,* reference number 63230-216-234
- *Contact Sheet/Registration Card*, number 63220-060-79

The following documents are available online at www.powerlogic.com:

- This guide
- *Sepam™ Series 80: Metering, Protection, Control and Monitoring Guide,* reference number 63230-216-230 (for North American users)
- *Sepam™ Series 80: Modbus Communication,* reference number 63230-216-231 (for North American Users)
- *DNP3 Communication Manual*, reference number 63230-216-236
- *IEC 60870-5-103 Communication Manual*, reference number 63230-216-237
- *Sepam™ Family Catalog*, reference number 63230-216-238

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Sepam™ Series 80 Equipment List
Main Units

⚠ CAUTION

LOSS OF PROTECTION
If dc control power is used, a backup power source is recommended to supply control power to the Sepam™ Series 80 during a power outage.

Failure to observe this precaution can cause the Series 80 to become inoperative if primary control power is lost.

U.S. Catalog*	Description**
SQ1 S80 A	S80 (substa) adv UMI 24-250 Vdc
SQ1 S81 A	S81 (substa) adv UMI 24-250 Vdc
SQ1 S82 A	S82 (substa) adv UMI 24-250 Vdc
SQ1 T81 A	T81 (transformer) adv UMI 24-250 Vdc
SQ1 T82 A	T82 (transformer) adv UMI 24-250 Vdc
SQ1 M81 A	M81 (motor) adv UMI 24-250 Vdc
SQ1 G82 A	G82 (generator) adv UMI 24-250 Vdc
SQ1 M87 A	M87 (motor) adv UMI 24-250 Vdc
SQ1 G87 A	G87 (generator) adv UMI 24-250 Vdc
SQ1 T87 A	T87 (transformer) adv UMI 24-250 Vdc
SQ1 M88 A	M88 (motor) adv UMI 24-250 Vdc
SQ1 G88 A	G88 (generator) adv UMI 24-250 Vdc
SQ1 S84 A	S84 (substa) adv UMI 24-250 Vdc
SQ1 B80 A	B80 (bus) adv UMI 24-250 Vdc
SQ1 B83 A	B83 (bus) adv UMI 24-250 Vdc
SQ1 C86 A	C86 (capbank) adv UMI 24-250 Vdc

**** Suffix:***
A - *includes LCD display, LEDs, PBs, front port in advanced User Machine Interface (UMI(*
P - *larger mimic-based LCD display, LEDs, PBs, front port in "Pro" UMI*
B - *receives no UMI. Requires remote display DSM303 for local panel UMI*

***** Application***
Application features may be found in "Selection Table", page 5 of this manual.

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Sepam™ Series 80 Equipment List
Accessories

U.S. Catalog	Description
DSM303	Remote advanced UMI module
AMT880	Sepam™ Series 80 mounting plate
CCA630	Connector for 1A / 5A CT current sensors
CCA634	Connector for 1A / 5A + Ir Current Transformer (CT) current sensors
CCT640	Connector for VT voltage sensors
	Working language English/French
	Working language English/Spanish
SFT080	Logipam option
MCS025	Sync-check module
MES120	14 input + 6 output module / 24-250 V DC
MES120G	14 input + 6 output module / 220-250 V DC
MES120H	14 input + 6 output module / 110-125 V DC
ACE969TP	2-wire RS485 multi-protocol interface (Modbus, DNP3 or IEC 60870-5-103)
ACE969FO	Fiber-optic multi-protocol interface (Modbus, DNP3 or IEC 60870-5-103)
CSH30	Interposing ring CT for Ir input
CSH120	Residual current sensor, diameter 4.75 in (120 mm)
CSH200	Residual current sensor, diameter 7.87 in (200 mm)
AMT852	Lead sealing accessory
MET1482	8-temperature sensor module
ACE949	2-wire RS485 network interface
ACE959	4-wire RS485 network interface
ACE937	Ffiber optic interface
ACE969FO	T/P and F/O
ACE969TP	T/P and T/P
MSA141	1 analog output module
ACE9092	RS485/RS232 convertor
ACE919 AC	RS485/RS485 interface (AC power supply)
ACE919 DC	RS485/RS485 interface (DC power supply)
CCA770	Remote module cable, L = 2 ft (0.6 m)
CCA772	Remote module cable, L = 6.6 ft (2 m)
CCA774	Remote module cable, L = 13.1 fr (4 m)
CCA783	PC connection cable
CCA613	Remote LPCT test plug
ACE917	LPCT injection adapter
AMT840	MCS025 mounting plate
ACE990	Zero sequence CT interface for Ir input
SFT2841CD	CD-ROM with SFT2841 and SFT2826 software (without CCA83 cable)
CD SFT2885	CD-ROM with Logipam software
AMT820	Blanking plate

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Sepam™ Series 80 Equipment List
Replacement Equipment

U.S. Catalog	Description
CCA671	Connector for LPCT current sensors
SEP080	Base unit without UMI, 24-250 V DC power supply
SEP383	Base unit with advanced UMI, 24-250 V DC power supply
SEP888	Base unit with mimic-based UMI, 24-250 V DC power supply
MMS020S80	Substation application type S80 Memory Cartridges
MMS020S81	Substation application type S81 Memory Cartridges
MMS020S82	Substation application type S82 Memory Cartridges
MMS020S84	Substation application type S84 Memory Cartridges
MMS020T81	Transformer application type T81 Memory Cartridges
MMS020T82	Transformer application type T82 Memory Cartridges
MMS020T87	Transformer application type T87 Memory Cartridges
MMS020M81	Motor application type M81 Memory Cartridges
MMS020M87	Motor application type M87 Memory Cartridges
MMS020M88	Motor application type M88 Memory Cartridges
MMS020G82	Generator application type G82 Memory Cartridges
MMS020G87	Generator application type G87 Memory Cartridges
MMS020G88	Generator application type G88 Memory Cartridges
MMS020B80	Bus application type B80 Memory Cartridges
MMS020B83	Bus application type B83 Memory Cartridges
MMS020C86	Capacitor application type C86 Memory Cartridges
CCA612	RS485 network interface communication cable, L = 9.8 ft (3 m)
CCA785	MCS025 module connection cable
CCA620	20-pin screw type connector
CCA622	20-pin ring lug connector
2640KIT	Kit with two sets of spare connectors for MES

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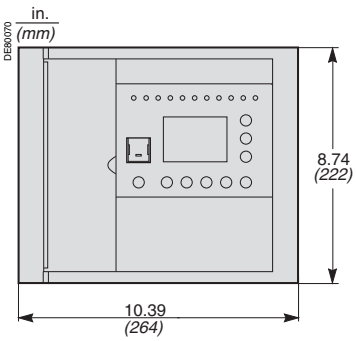
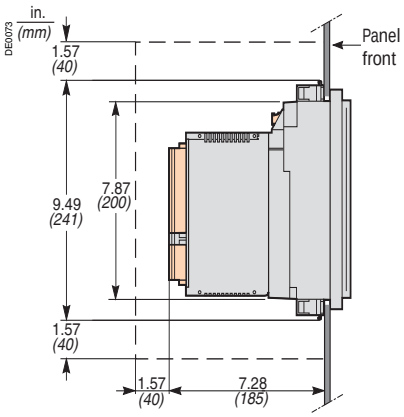
Base Unit
Dimensions

Dimensions

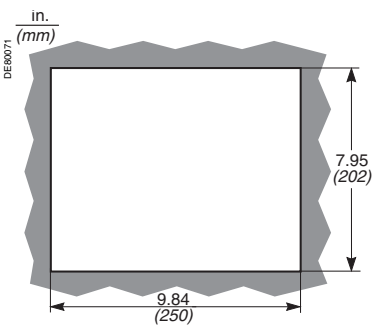


Front View of Sepam™

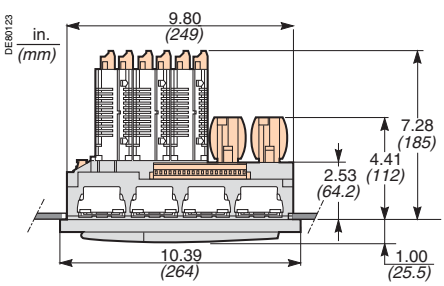


Side view of Sepam™ with MES120, flush-mounted in front panel with spring clips.
Front panel: 1.5 mm (0.05 in) to 6 mm (0.23 in) thick

***Note**: Dashed lines | _ _ | represent clearance needed for Sepam™ assembly and wiring*

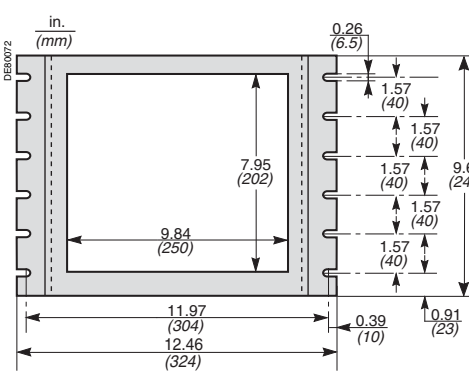


Cut Out

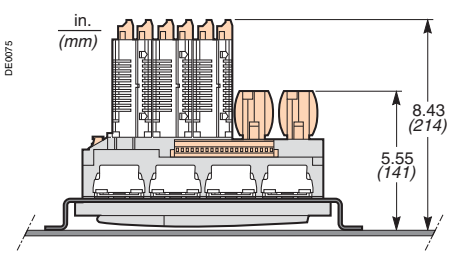


Top view of Sepam™ with MES120, flush-mounted in front panel with spring clips
Front panel: 1.5 mm (0.05 in) to 6 mm (0.23 in) thick

Assembly with AMT880 Mounting Plate



AMT880 Mounting Plate



Top view of Sepam™ with MES120, flush-mounted in front panel with spring clips.
Mounting plate: 3 mm (0.11 in) thick

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Base Unit
Mounting

Spring Clip Mounting Direction

The direction the spring clips are mounted depends on the thickness of the mounting frame. The top clips are mounted in the opposite direction to the bottom clips.

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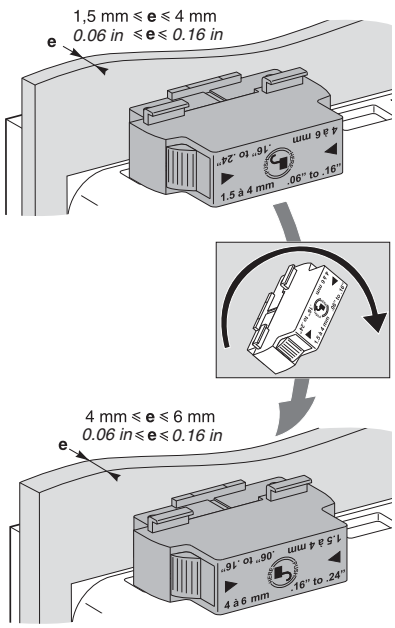

Base Unit Flush-Mounting

The Sepam™ Series 80 uses eight spring clips to frame mount the unit. The mounting surface must be flat and stiff to guarantee tightness.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Turn off all power supplying the power meter and the equipment in which it is installed before working on it. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.

Failure to follow these instructions will result in death or serious injury.

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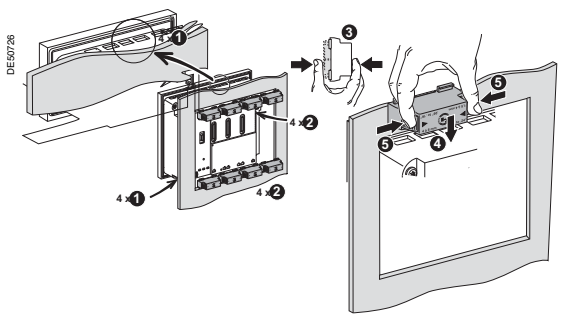

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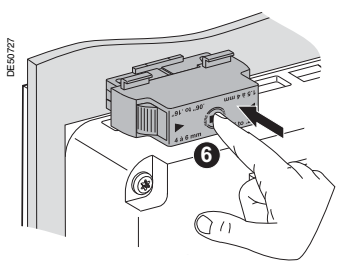
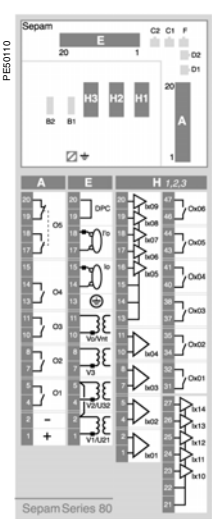


❶ Mounting notches
❷ Spring clips
❸ Setting
❹ Positioning
❺ Locking
❻ Unlocking

PE50110



Terminal block identification label

Attaching the Terminal Block Identification Label

A sticker showing the rear panel of Sepam™ and terminal assignments comes with each base unit to help connect Sepam™ and the MES120 input/output modules. This label is usually on the side of an MES120 module or on a side panel of Sepam™ (usually the right side or bottom).

Refer to the figures above and perform the following steps to mount the base unit:

1 Shut off all power sources for the equipment cubicle.
2 Locate the mounting notches at the top and bottom of the case ❶
3 Determine clip mounting direction based on the panel sheet thickness. ❷
4 Compress and latch the spring clips. ❸
5 Insert the case into the prepared cut-out of the cubicle and insert spring clips in the notches at the top and bottom. ❹
6 Squeeze to release and lock the latched clips and hold relay to panel. ❺
7 To unlock the clip and remove the case, press the end of each clip toward the panel. ❻

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Base Unit
Connection

Items located on the rear panel are:

1 Base unit
2 Eight spring clips (four top, four bottom)
3 Red LED: Sepam™ unavailable
4 Green LED: Sepam™ on
5 Gasket

(A) 20-pin connector for:

- 24 V DC to 250 V DC auxiliary supply
- five relay outputs

(B1) Connector for 3 phase current Ia, Ib, Ic inputs

(B2) Sepam™ T87, M87, M88, G87, G88: connector for 3-phase current I'a, I'b, I'c inputs
- Sepam™ B83: connector for
  - ☐ 3-phase voltage V'an, V'bn, V'cn inputs
  - ☐ 1 residual voltage V'r input (see page 25)
- Sepam™ C86: connector for capacitor unbalance current inputs (see page 29)

(C1) Communication port 1

(C2) Communication port 2

(D1) Remote module connection port 1

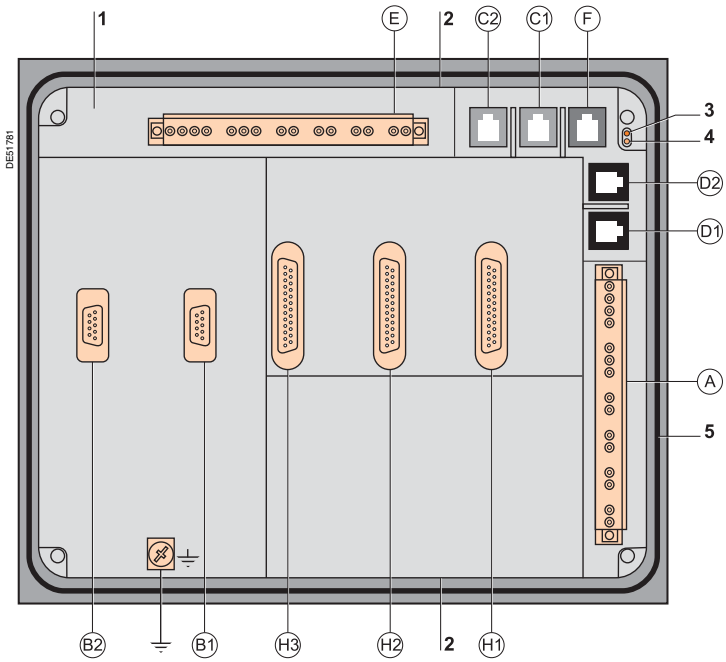
(D2) Remote module connection port 2

(E) 20-pin connector for:

- 3 phase voltage Van, Vbn, Vcn inputs
- 1 residual voltage Vr input
- 2 residual current Ir, I'r inputs

(F) Spare port

Rear Panel Description



(H1) Connector for first MES120 input/output module.

(H2) Connector for second MES120 input/output module.

(H3) Connector for third MES120 input/output module.

⏚ Functional ground.

Connection Characteristics

Connector	Type	Reference	Wiring
(A), (E)	Screw type	CCA620	Wiring with no fittings: ■ 1 wire with max. cross-section 0.2 to 2.5 mm² (≥ AWG 24-12) or 2 wires with max. cross-section 0.2 to 1 mm² (≥ AWG 24-16) ■ Stripped length: 8 to 10 mm (0.31 to 0.39 in) Wiring with fittings: ■ Recommended wiring with Telemecanique fittings: □ DZ5CE015D for 1 x 1.5 mm² wire (AWG 16) □ DZ5CE025D for 1 x 2.5 mm² wire (AWG 12) □ AZ5DE010D for 2 x 1 mm² wires (AWG 18) ■ Tube length: 8.2 mm (0.32 in) ■ Stripped length: 8 mm (0.31 in)
	6.35 mm (0.25 in) ring lugs	CCA622	■ 6.35 mm ring or spade lugs (0.25 in) (1/4") ■ Maximum wire cross-section of 0.2 to 2.5 mm² (≥ AWG 24-12) ■ Stripped length: 6 mm (0.23 in) ■ Use an appropriate tool to crimp the lugs on the wires ■ Maximum of 2 ring or spade lugs per terminal ■ Tightening torque: 6.1 - 8.8 in-lb (0.7 to 1 Nm)
(B1), (B2)	4 mm (0.15 in) ring lugs	CCA630 or CCA634, to connect 1A or 5A CTs	1.5 to 6 mm² (AWG 16-10)
	RJ45 plug	CCA671, to connect 3 LPCT sensors	Integrated with LPCT sensor
(C1), (C2)	Green RJ45 plug		CCA612
(D1), (D2)	Black RJ45 plug		CCA770: L = 2 ft (0.6 m) CCA772: L = 6.6 ft (2 m) CCA774: L = 13.1 ft (4 m) CCA785 for MCS025 module: L = 6.6 ft (2 m)
DE51845 ⏚ Functional ground	Ring lug		Grounding braid, to be connected to cubicle ground: ■ Flat copper braid with cross-section ⩾ 9 mm² (> AWG 8) ■ Maximum length: 11.8 in (300 mm)

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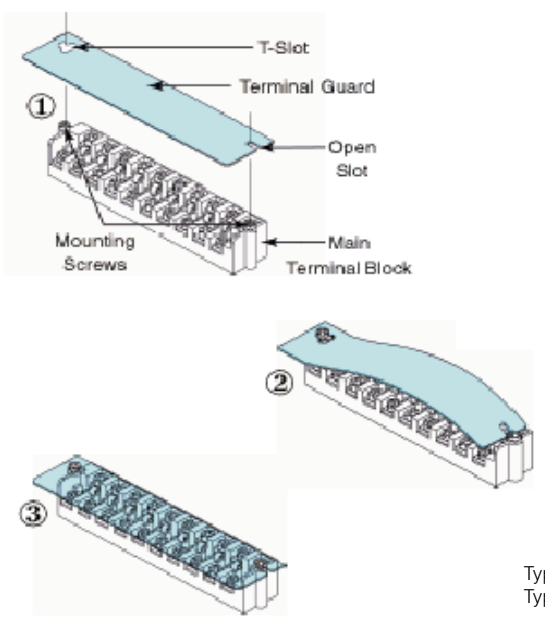
Base Unit
Installing Terminal Guard

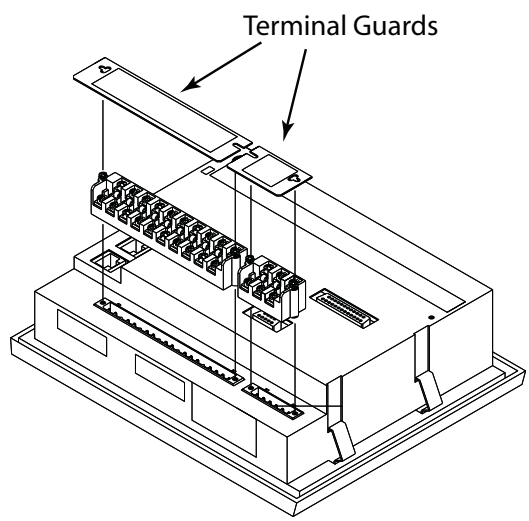
Terminal guards are shipped with each ring-lug type main and VT terminal block. These guards must be installed after the terminal block is wired, but before the Sepam™ Series 80 and equipment wired to the module are energized. (See preceding DANGER notice.) These terminal guards are designed to prevent accidental contact with terminals once they are energized.

To install the terminal guards, follow these steps while referring to the illustrations below:

1 Slightly loosen the two module mounting screws on the ends of one of the blocks.
2 Place the T-slot in the terminal guard over one of the mounting screws and pull it toward the center of the module until the mounting screw is in the narrow portion of the T-slot. Tighten the mounting screw.
3 Gently flex the terminal guard as shown and slide the open slot on the terminal guard under the head of the mounting screw so the screw secures it in place. Release the terminal guard so it lies flat over the terminals. Tighten the mounting screw.

Repeat steps 1 and 2 to install the other terminal guard.
The terminal guards should now be firmly in place, preventing accidental contact with the terminals they cover.





Typical Terminal Block Mounting (Shown for Sepam™ Series 20/40)
Typical for Series 80

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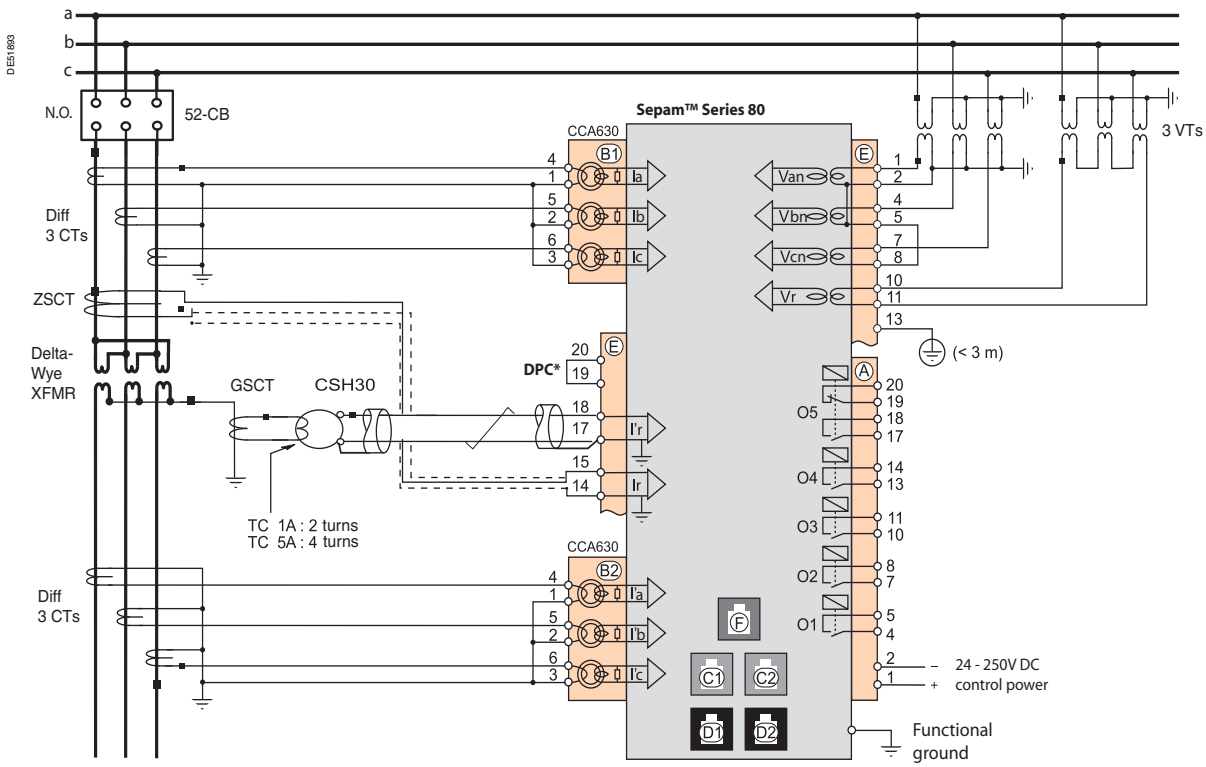
Base Unit
Sepam™ Series 80 AC Connection Diagram



Note: *See Connection Characteristics, page 17*

** Detection of Plugged Connector (required for proper operation. Installed manually)*

⚠ CAUTION

LOSS OF PROTECTION OR RISK OF NUISANCE TRIPPING

If Sepam™ loses power or is in fail-safe position, the protection functions are inactive and all Sepam™ output relays drop out. Check to ensure this operating mode and the watchdog relay wiring are compatible with your installation.

Failure to follow this instruction can result in equipment damage and unwanted shutdown of the electrical installation.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electrical power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

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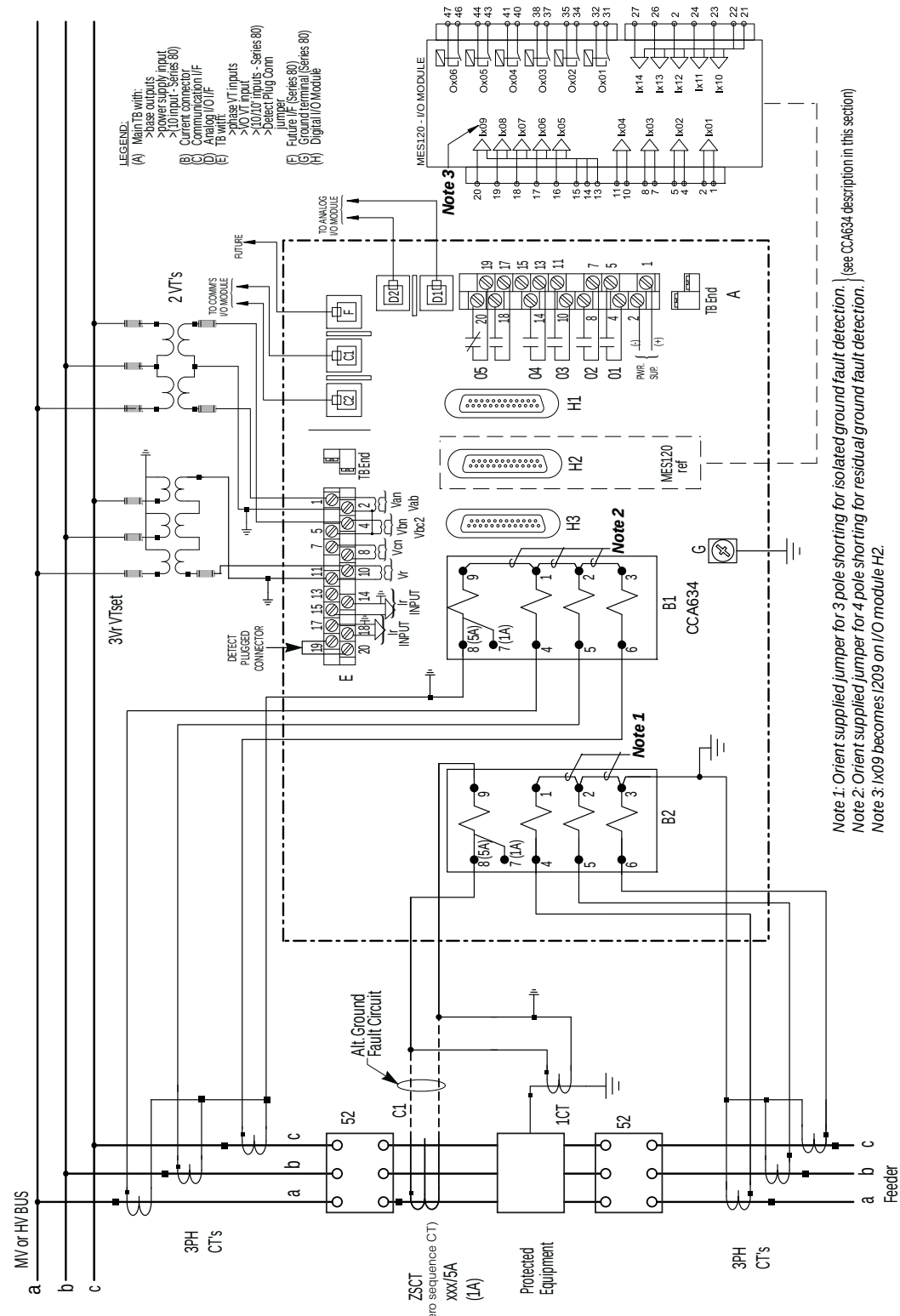
Base Unit
Sepam™ Series 80 AC Connection Diagram



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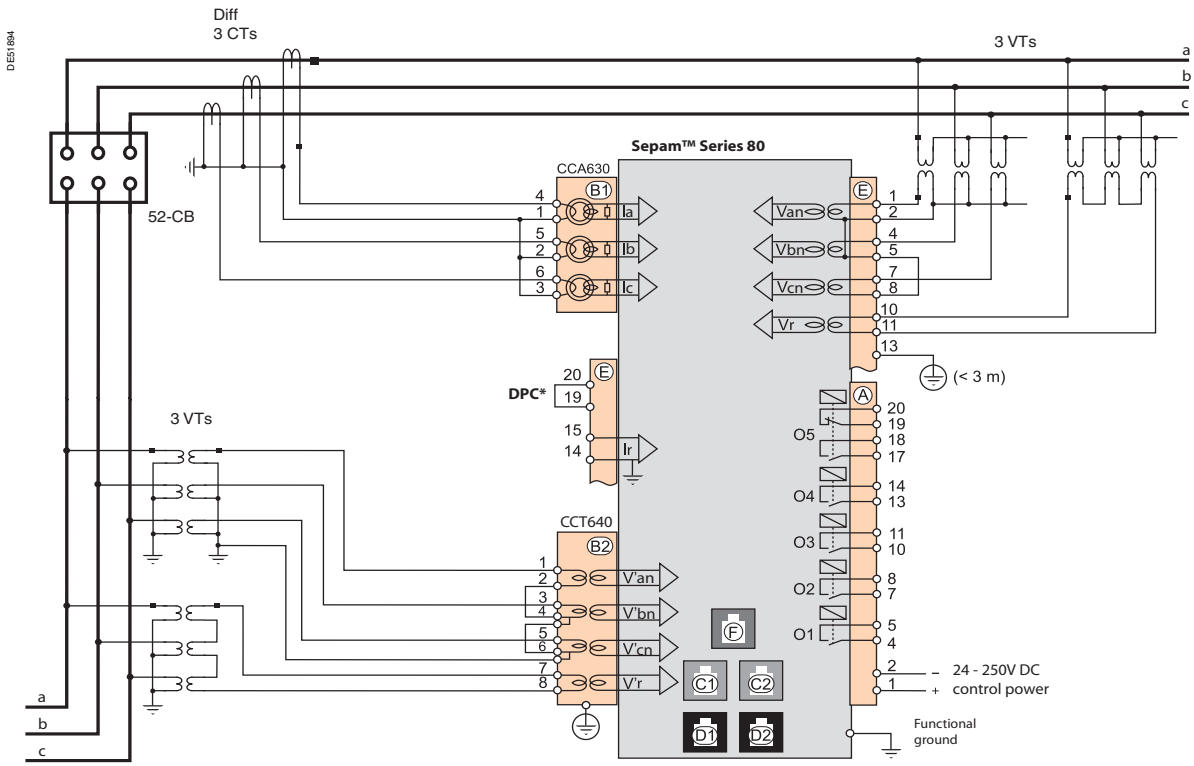
Base Unit
Sepam™ B83 Connection Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Connector	Type	Reference	Wiring
B1	0.15 in (4 mm) ring lugs	CCA630 or CCA634, for connection of 1 A or 5 A ZSCTs	1.5 to 6 mm² (AWG 16-10)
B2	Screw type	CCT640	VT wiring: same as wiring for the CCA620 Ground connection is by a 4 mm ring lug
DE51845 Functional ground	Ring lug		Connect the grounding braid to cubicle ground: ■ Flat copper braid with cross-section ≥ 9 mm² (> AWG 8) ■ Maximum length: 11.8 in (300 mm) ■ Tightening torque: 6.1 - 8.8 in-lb (0.7 to 1.0 Nm)

Connection characteristics of connectors A, E, C1, C2, D1, D2 : see page 20

⚠ CAUTION

LOSS OF PROTECTION OR RISK OF NUISANCE TRIPPING

If Sepam™ loses power or is in fail-safe position, the protection functions are inactive and all the Sepam™ output relays drop out. Check to ensure that this operating mode and the watchdog relay wiring are compatible with your installation.

Failure to follow this instruction can result in equipment damage and unwanted shutdown of the electrical installation.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electrical power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

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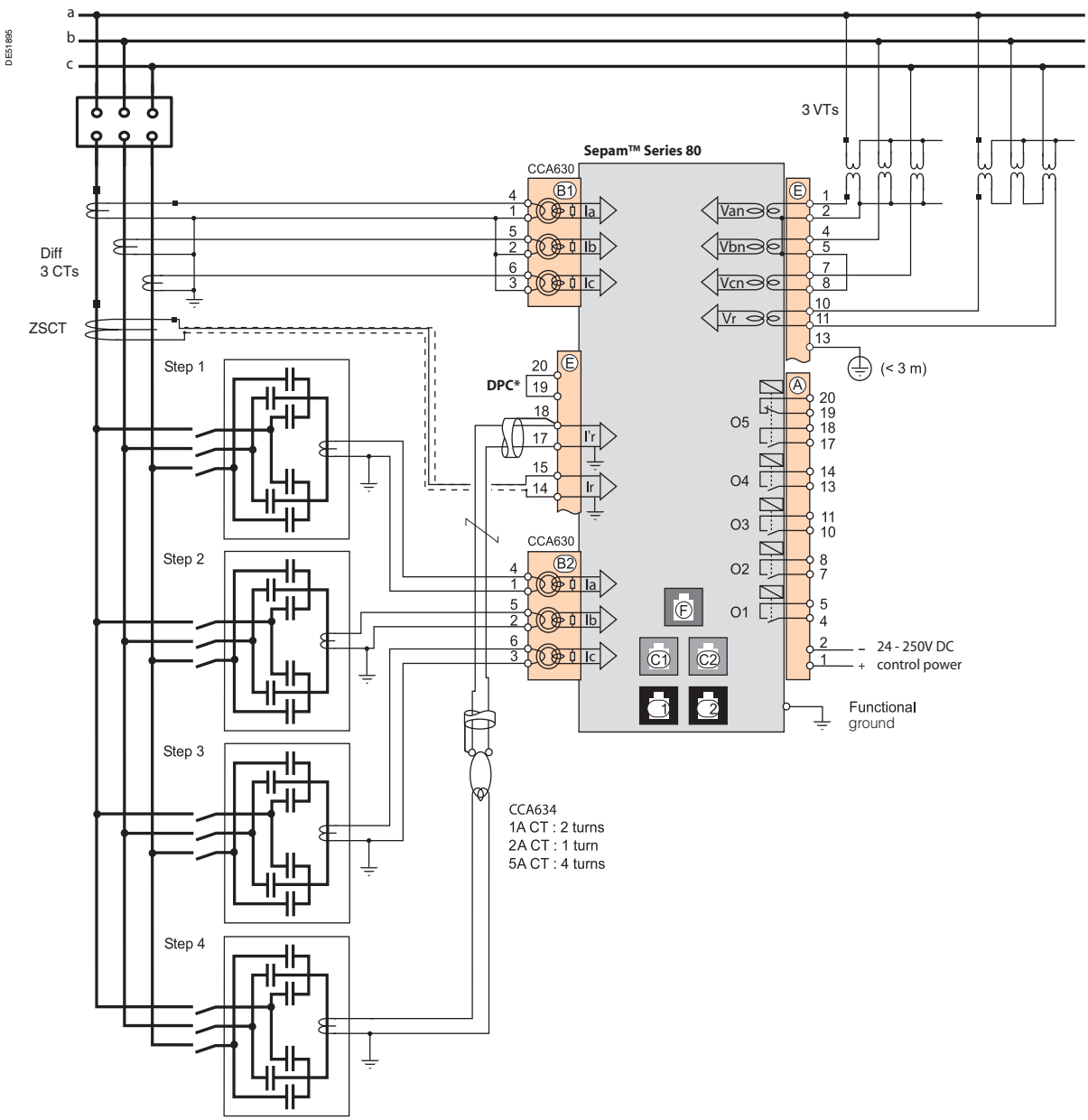
Base Unit
Sepam™ C86 Connection Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Connector	Type	Reference	Wiring
(B1)	0.15 in (4 mm) ring lugs	CCA630 or CCA634, for connecting 1A or 5A CTs	1.5 to 6 mm² (AWG 16-10)
	RJ45 plug	CCA671, for connecting three LPCT sensors	Integrated with LPCT sensor
(B2)	0.15 in (4 mm) ring lugs	CCA630 or CCA634, for connecting 1A, 2A or 5A CTs	1.5 to 6 mm² (AWG 16-10)
DE51845 Functional ground	Ring lugs		Connect the grounding braid to the cubicle ground: ■ Flat copper braid with cross-section ≥ 9 mm² (>AWG 8) ■ Maximum length: 11.8 in (300 mm) ■ Tightening torque: 6.1 - 8.8 in-lb (0.7 to 1.0 Nm)

Connection characteristics of connectors (A), (E), (C1), (C2), (D1), (D2) : see page 20

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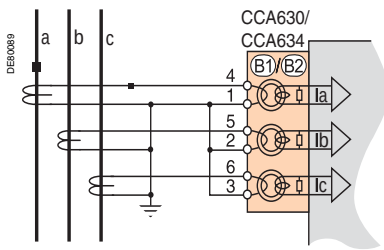
Base Unit
Connecting Phase Current Inputs

Variant 1: Measuring Phase Current by three - 1A or 5A CTs (Standard Connection)



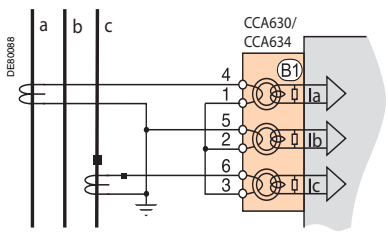
Description
Connecting three - 1A or 5A sensors to the CCA630 or CCA634 connector.

Calculate residual current by measuring the three-phase currents.

Parameters

Sensor type	5A CT or 1A CT
Number of CTs	Ia, Ib, Ic
Rated Current (IN)	1A to 6250 A

Variant 2: Measuring Phase Current by two - 1A or 5A CTs



Description
Connecting two - 1A or 5A sensors to the CCA630 or CCA634 connector. All protection functions are based on monitoring phase A and phase C currents.

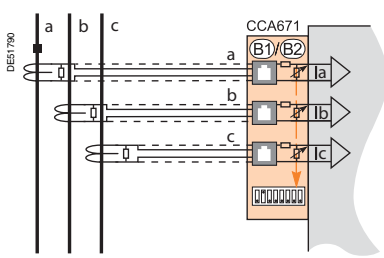
Phase current IB is assessed only for metering functions (assuming Ir = 0).

The user cannot calculate residual current or use ANSI 87T and 87M differential protection functions on the Sepam™ T87, M87, M88, G87 and G88 under this configuration.

Parameters

Sensor type	5A CT or 1A CT
Number of CTs	Ia, Ic
Rated Current (IN)	1A to 6250 A

Variant 3: Measuring Phase Current with three LPCT Type Sensors



Description
The CCA671 Connector uses three Low Power Current Transducer (LPCT) type sensors to keep Sepam™ from going into a fail-safe condition.

There are three sets of Dual In-Line (DIP) switches, shown at the bottom of the CCA671 example to the left, one set for each phase. Each of these is set for the Full Load Amps (FLA) for that phase.

Calculate residual currentby measuring the three phase currents Ia, Ib, and Ic. They are measured by 3 x 1A or 5A CTs or by three LPCT type sensors.

LPCT sensors cannot be used to obtain the following measurements:

- Phase current measurements for Sepam™ T87, M88 and G88 with ANSI 87T transformer differential protection (connectors B1 and B2)
- Phase current measurements for Sepam™ B83 (connector B1)
- Unbalance current measurements for Sepam™ C86 (connector B2).

Parameters

Sensor type	LPCT
Number of CTs	Ia, Ib, Ic
Rated Current (IN)	25, 50, 100, 125, 133, 200, 250, 320, 400, 500, 630, 666, 1000, 1600, 2000 or 3150 A

Note : *Rated Current (IN) must be set twice, because:*

- *The software parameter setting uses the advanced UMI or the SFT2841 software tool.*
- *The hardware parameter setting uses microswitches on the CCA671 connector.*

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Base Unit
Connecting Residual Current Inputs

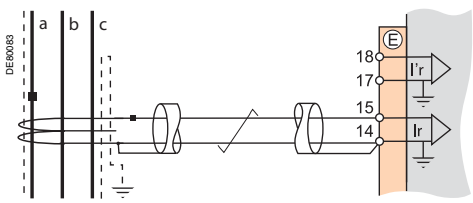
Variant 1: Calculating Residual Current by Sum of Three Phase Currents

Description
Residual current is calculated by vectorially summing the three phase currents Ia, Ib and Ic, which are measured by three x 1A or 5A CTs or by three LPCT type sensors. See the current input connection diagrams for more information.

Parameters

Residual Current	Rated Residual Current	Measuring Range
Sum of the three currents	I_{Nr} = I_N, CT primary current	0.01 to 40 I_{Nr} (minimum 0.1 A)

Variant 2: Measuring Residual Current by CSH120 or CSH200 Zero Sequence CT (Standard Connection)

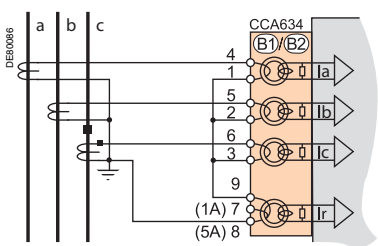


Description
Use this arrangement to protect isolated or compensated neutral systems having very low fault currents that need to be detected.

Parameters

Residual Current	Rated Residual Current	Measuring Range
2 A rating CSH	I_{Nr} = 2 A	0.1 to 40 A
20 A rating CSH	I_{Nr} = 20 A	0.2 to 400 A

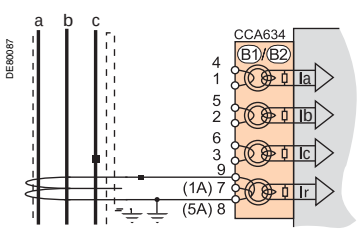
Variant 3: Measuring Residual Current by 1A or 5A CTs and CCA634



Description
Residual current measurement by 1A or 5A CTs
- Terminal 7: 1A CT
- Terminal 8: 5A CT

Parameters

Residual Current	Rated Residual Current	Measuring Range
1 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)
5 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)



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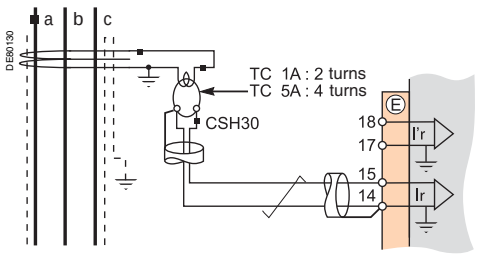
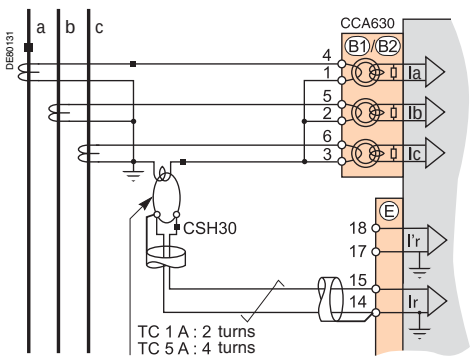
Variant 4: Measuring Residual Current by 1A or 5A CTs and CSH30 Interposing Ring CT





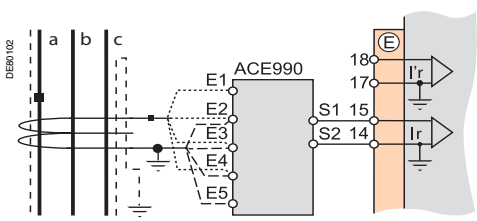
Description
The CSH30 interposing ring CT connects 1A or 5A CTs to Sepam™ to measure residual current:

- CSH30 interposing ring CT connected to 1A CT: make two turns through CSH primary
- CSH30 interposing ring CT connected to 5A CT: make four turns through CSH primary.

Parameters

Residual Current	Rated Residual Current	Measuring Range
1 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)
5 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)

Variant 5: Measuring Residual Current by Zero Sequence CT with Ratio of 1/n (n between 50 and 1500)



Description
The ACE990 is an interface between a MV zero sequence CT with a ratio of 1/n (50 ≤ n ≤ 1500) and the Sepam™ residual current input.

This arrangement allows the continued use of existing zero sequence CTs on the installation.

Parameters

Residual Current	Rated Residual Current	Measuring Range
ACE990 - range 1 (0.00578 ≤ k ≤ 0.04)	I_{Nr} = Ik.n(1)	0.01 to 20 I_{Nr} (minimum 0.1 A)
ACE990 - range 2 (0.0578 ≤ k ≤ 0.26316)	I_{Nr} = Ik.n(1)	0.01 to 20 I_{Nr} (minimum 0.1 A)

(1) *n = number of zero sequence CT turns*
k = factor to be determined according to ACE990 wiring and setting range used by Sepam™

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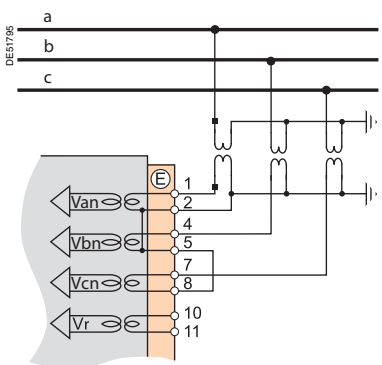
Base Unit
Connecting Main Voltage Inputs

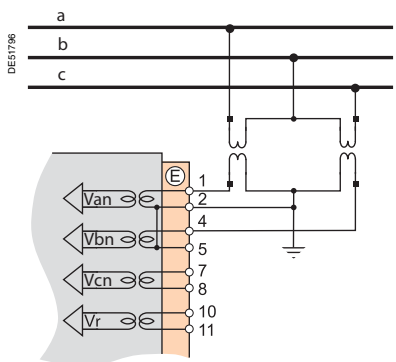
Phase Voltage Input Connection Variants

Variant 1: Measuring Three Phase-to-Neutral Voltages (3 V_{Ln}, Standard Connection)



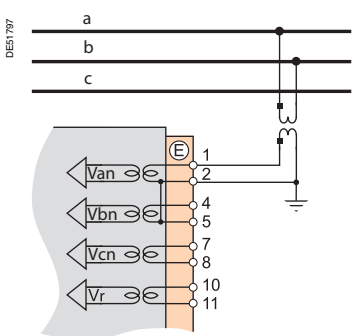
Measuring three phase-to-neutral voltages allows the calculation of residual voltage, VrΣ

Variant 2: Measuring Two Phase-to-Phase Voltages (2 V_{LL})



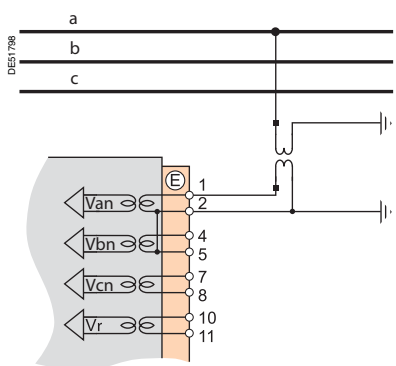
This variant does not allow residual voltage calculation

Variant 3: Measuring One Phase-to-Phase Voltage (1 V_{LL})



This variant does not allow residual voltage calculation

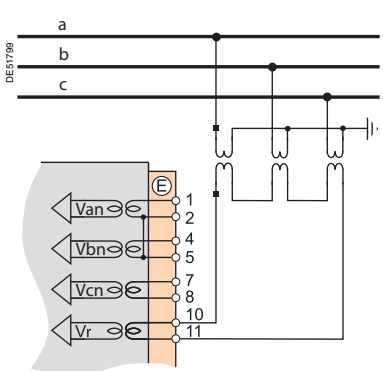
Variant 4: Measuring One Phase-to-Neutral Voltage (1 V_{Ln})



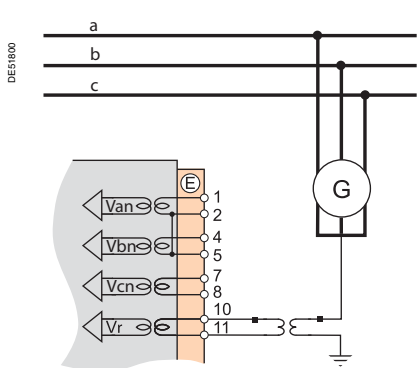
This variant does not allow residual voltage calculation

Residual Voltage Input Connection Variants

Variant 5: Measuring Residual Voltage Vr



Variant 6: Measuring Residual Voltage VNT in Generator Neutral Point



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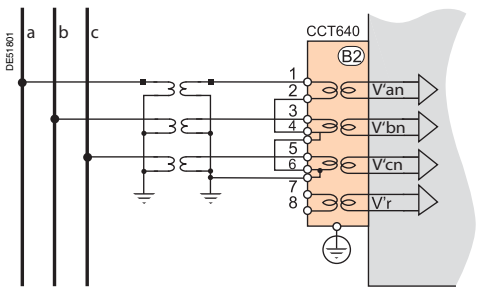
Base Unit
Connecting Additional Voltage Inputs for Sepam™ B83

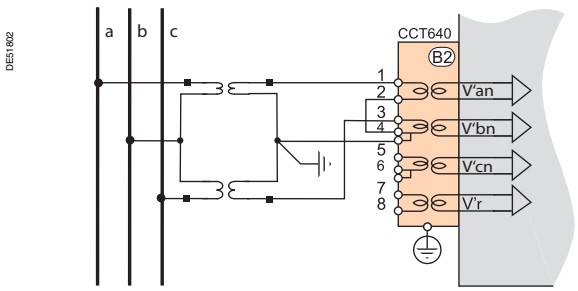
Additional Phase Voltage Input Connection Variants

Variant 1: Measuring Three Phase-to-Neutral Voltages (3 V_{Ln}, Standard Connection)



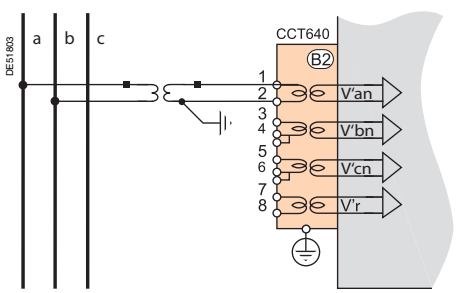
You can calculate residual voltage by measuring the three phase-to-neutral voltages, V'rΣ.

Variant 2: Measuring Two Phase-to-Phase Voltages (2 V_{LL})



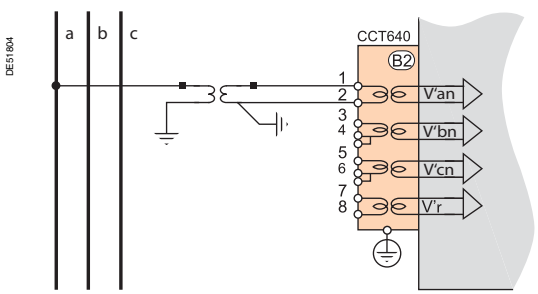
This variant does not allow residual voltage calculation.

Variant 3: Measuring One Phase-to-Phase Voltage (1 V_{LL})



This variant does not allow residual voltage calculation.

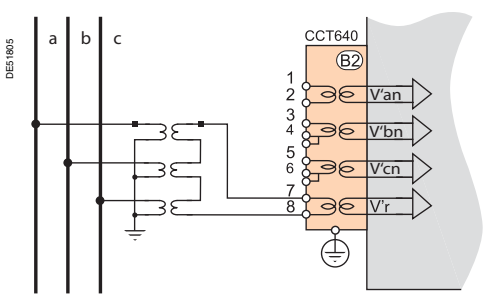
Variant 4: Measuring One Phase-to-Neutral Voltage (1 V_{Ln})



This variant does not allow the calculation of residual voltage.

Additional Residual Voltage Input Connection

Variant 5: Measuring Residual Voltage V'r



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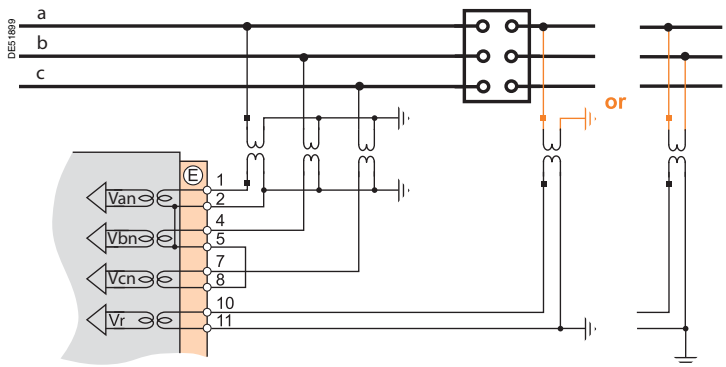
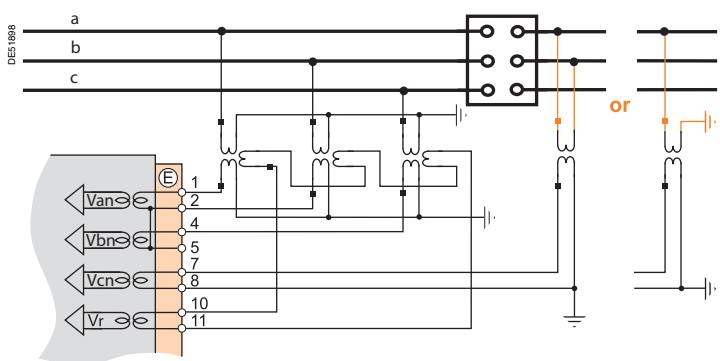
Base Unit
Connecting Additional Phase Voltage Input for Sepam™ B80

Connection to Measure an Additional Voltage



This connection is used to measure:

- three phase-to-neutral voltages Van, Vbn, Vcn on bus no. 1
- one additional phase-to-neutral voltage V'an (or one additional phase-to-phase voltage V_{LL}) on bus no. 2



This connection is used to measure:

- two phase-to-phase voltages Vab, Vbc and one residual voltage Vr on bus no. 1
- one additional phase-to-phase voltage V_{LL} (or one additional phase-to-neutral voltage V'an) on bus no. 2

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Base Unit
Functions Available According to Connected Voltage Inputs

The phase and residual voltages that Sepam™ measures determine the availability of some protection and metering functions.

The table below gives the voltage input connection variants for each protection and metering function that depends on measured voltages.

Example:
The directional ground fault protection is ANSI 67N/67NC. It uses residual voltage Vr as a polarization value.
It is operational in the following cases:
- measuring the three phase-to-neutral voltages and calculating the variant, (3 V_{LN} + VrΣ, variant 1)
- measuring residual voltage Vr (variant 5).

Directional ground fault protection is ANSI67N/67NC.
The protection and metering functions not appearing in the table below are available regardless of the voltages measured.

Phase Voltages Measured (connection variant)		**3 V_{LN} + VrΣ** (var. 1)			**2 V_{LL}** (var. 2)			**1 V_{LL}** (var. 3)			**1 V_{LN}** (var. 4)		
Residual Voltage Measured (connection variant)		**–**	**Vr** (v. 5)	**VNT** (v. 6)	**–**	**Vr** (v. 5)	**VNT** (v. 6)	**–**	**Vr** (v. 5)	**VNT** (v. 6)	**–**	**Vr** (v. 5)	**VNT** (v. 6)
Protection Functions Dependent on Voltages Measured													
Directional phase overcurrent	67	■	■	■	■	■	■						
Directional ground fault	67N/67NC	■	■	■		■			■			■	
Directional active overpower	32P	■	■	■	■	■	■						
Directional reactive active overpower	32Q	■	■	■	■	■	■						
Directional active underpower	37P	■	■	■	■	■	■						
Field loss (underimpedance)	40	■	■	■	■	■	■						
Pole slip, phase shift	78PS	■	■	■	■	■	■						
Voltage-restrained overcurrent	50V/51V	■	■	■	■	■	■						
Underimpedance	21B	■	■	■	■	■	■						
Inadvertent energization	50/27	■	■	■	■	■	■						
100 % stator ground fault	64G2/27TN			■			■						
Overfluxing (V/Hz)	24	■	■	■	■	■	■	■	■	■	■	■	■
Positive sequence undervoltage	27D	■ □	■ □	■	■ □	■ □	■						
Remanent undervoltage	27R	■ □	■ □	■	■ □	■ □	■	■ □ ☑	■ □	■	■ □ ☑	■ □	■
Undervoltage (L-L or L-N)	27	■ □	■ □	■	■ □	■ □	■	■ □ ☑	■ □	■	■ □ ☑	■ □	■
Overvoltage (L-L or L-N)	59	■ □	■ □	■	■ □	■ □	■	■ □ ☑	■ □	■	■ □ ☑	■ □	■
Neutral voltage displacement	59N	■ □	■ □	■		■ □	■		■ □	■		■ □	■
Negative sequence overvoltage	47	■ □	■ □	■	■	■ □	■					■ □	
Overfrequency	81H	■ □	■ □	■	■ □	■ □	■	■ □ ☑	■ □	■	■ □ ☑	■ □	■
Underfrequency	81L	■ □	■ □	■	■ □	■ □	■	■ □ ☑	■ □	■	■ □ ☑	■ □	■
Rate of change of frequency	81R	■	■	■	■	■	■						
Measurements Dependent on Voltages Measured													
Phase-to-phase voltage Vab, Vbc, Vca or V'ab, V'bc, V'ca		■ □	■ □	■	■ □	■ □	■ □	Vab, V'ab	Vab	Vab			
Phase-to-neutral voltage Van, Vbn, Vcn or V'an, V'bn, V'cn		■ □	■ □	■		■					Van, V'an	Van, V'an	Van
Residual voltage Vr or V'r		■ □	■ □	■		■ □			■ □			■ □	
Neutral point voltage Vnt				■			■			■			■
Third harmonic neutral point or residual voltage				■			■			■			■
Positive sequence voltage V1 or V'1 / negative sequence voltage V2 or V'2		■ □	■ □	■	■ □	■ □	■						
Frequency (f)		■ □	■ □	■ □	■ □	■ □	■ □	■ □ ☑	■ □	■ □	■ □ ☑	■ □	■ □
Active / reactive / apparent power: P, Q, S		■	■	■	■	■	■	■	■	■			
Peak demand power PM, QM		■	■	■	■	■	■	■	■	■			
Active / reactive / apparent power per phase: Pa/Pb/Pc, Qa/Qb/Qc, Sa/Sb/Sc		■ (1)	■ (1)	■ (1)		■ (1)					Pa/ Qa/Sa	Pa/ Qa/Sa	Pa/ Qa/Sa
Power factor (pf)		■	■	■	■	■	■	■	■	■			
Calculated active and reactive energy (±Wh, ±VARh)		■	■	■	■	■	■	■	■	■			
Total harmonic distortion, voltage Vthd		■	■	■	■	■	■	■	■	■			
Phase displacement φr, φ'r		■	■	■		■			■			■	
Phase displacement φa, φb, φc		■	■	■	■	■	■						
Apparent positive sequence impedance Z1		■	■	■	■	■	■						
Apparent phase-to-phase impedances Zab, Zbc, Zac		■	■	■	■	■	■						

■ *Function available on main voltage channels.*
□ *Function available on Sepam™ B83 additional voltage channels.*
☑ *Function available on Sepam™ B80 additional voltage channel, according to the type of the additional voltage measured.*
(1) *If all three phase currents are measured.*

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Function

Connect Sepam™ to any standard 1A or 5A CT. Schneider Electric offers a range of current transformers to measure primary currents from 50 A to 2500 A. Contact a Schneider Electric representative for more information.

Current Transformer Sizing

Current transformers should be large enough to minimize saturation. CTs should be selected per ANSI C37.110. This can be critical for high X/R systems with generators larger than 2MW.

		Normal Performance			Higher Performance		
Rated Secondary Current (I_N)	**CT Ratio(1)**	**Burden Designation**	**ANSI Class(2)**	**IEC Class(3)**	**Burden Designation**	**ANSI Class(4)**	**IEC Class(3)**
5	100/5	B-0.1	C10	2.5VA 5P20	B-0.2	C20	5VA 5P20
5	500/5	B-0.5	C50	15VA 5P20	B-1.0	C100	30VA 5P20
5	1200/5	B-2.0	C200	50VA 5P20	B-4.0	C400	100VA 5P20
1	100/1	B-0.1	C50	2.5VA 5P20	B-0.2	C100	5VA 5P20
1	500/1	B-0.5	C200	10VA 5P20	B-1.0	C400	30VA 5P20
1	1200/1	B-2.0	C1000(5)	40VA 5P20	B-4.0	C2000(5)	80VA 5P20

Transformer and Transformer-Machine Unit Differential Protection (ANSI 87T)
The phase CT primary currents must adhere to the following rule:

$$0.1\left(\frac{S}{\sqrt{3}\,V_{LLn1}}\right) \le I_N \le 2.5\left(\frac{S}{\sqrt{3}\,V_{LLn1}}\right)$$ for winding 1.

$$0.1\left(\frac{S}{\sqrt{3}\,V_{LLn2}}\right) \le I'_N \le 2.5\left(\frac{S}{\sqrt{3}\,V_{LLn2}}\right)$$ for winding 2.

where:

S is the transformer's rated power.
I_N and **I'_N** are the phase CT primary currents of winding 1 and 2 respectively.
V_{LLn1} and **V_{LLn2}** are winding 1 and 2 phase-to-phase voltages.

The rule of thumb is to size the primary and secondary CTR to 1.5XFLA. While the relay can accept substantially smaller CTR's, care should be taken when the CTR is below the rated FLA. Smaller CTR's generally result in a higher probability of saturation.

The current transformers should be defined by the knee-point voltage **$V_k \ge (R_{CT} + R_w)\ (20)\ I_N$**.

The equation applies to the phase current transformer windings 1 and 2, where:
I_N and **I'_N** are the CT rated primary and secondary currents respectively.
R_{CT} is the CT internal resistance.
R_w is the resistance of the CT load and wiring.

Machine Differential (ANSI 87M)

Current transformers should be defined by a minimum knee-point voltage
$V_k \ge (R_{CT} + R_w)\ (20) I_N$.
The equations apply to the phase current transformers placed on either side of the machine.
I_N is the CT rated secondary current
R_{CT} is the CT internal resistance.
R_w is the resistance of the CT load and wiring.

Generators are characterized by large X/R ratio's. The rule of thumb is to use the highest possible accuracy class. A completely offset short circuit current requires the ct to support (1+X/R) times the calculated voltage. In many applications it is not possible to completely avoid saturation. Under these conditions it is helpful to have machine differential ct's with the same knee point voltage

(1) *CT ratio rule of thumb is to size primary to be 1.5 x connected load.*
Example: 600/5. CT for 400A load.
(2) *Typical usual product offering from switchgear manufacturers in North Americe for 50/51 products.*
(3) *Highest listed VA in IEC 60044 is 30VA*
(4) *Suitable for systems with X/R=15, or small generator connected to bus. Minimum for 87 protection.*
(5) *Not listed in C57.13*

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Restricted Ground Fault Differential Protection (ANSI 64REF)

- The primary current of the neutral point current transformer used must comply with the following rule:
  0.1 I_N ≤ Neutral Point CT Primary Current ≤ 2 I_N
  where **I_N** = primary current of phase CTs on the same winding

Current transformers should be defined by the equation below that produces the highest knee-point voltage:

$Vk \geq (R_{CT} + Rw) \times 20\ I_N$
$Vk \geq (R_{CT} + Rw)\ (1.6\ I_{3P}/I_N) \times I_N$
$Vk \geq (R_{CT} + Rw)\ (2.4\ I_{1P}/I_N) \times I_N$

The equations apply to the phase current transformers and the neutral-point current tranformer, where

I_N is the CT rated secondary current.
R_{CT} is the CT internal resistance.
Rw is the resistance of the CT load and wiring.
I_{3P} is the maximum current value for a three-phase short circuit.
I_{1P} is the maximum current value for a phase-to-ground short circuit.

CCA630/CCA634 Connector

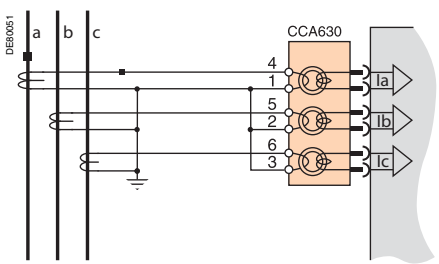
Function

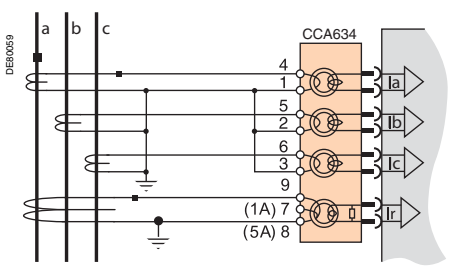
The current transformers (1A or 5A) are connected to the CCA630 or CCA634 connector on the rear panel of Sepam™:

- The CCA630 connector connects three phase current transformers to Sepam™.
- The CCA634 connector connects three phase current transformers and one zero sequence current transformer to Sepam™.

The CCA630 and CCA634 connectors contain interposing ring CTs with through primaries. When measuring phase and zero sequence currents, these primaries provide impedance matching and isolation between the 1A or 5A circuits and Sepam™.

The connectors can be disconnected with the power on since disconnection does not open the CT secondary circuit.





⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should only be performed after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Disconnect the Sepam™ unit current inputs by unplugging the CCA630 or CCA634 connector. Do not disconnect the wires from it. The CCA630 and CCA634 connectors ensure continuity of the current transformer secondary circuits.
- Short-circuit the current transformer secondary circuits before disconnecting the wires connected to the CCA630 or CCA634 connector.

Failure to follow these instructions will result in death or serious injury.

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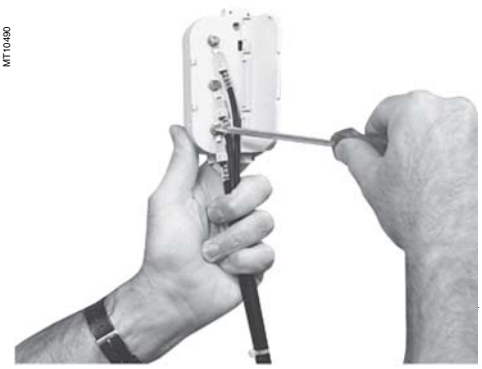
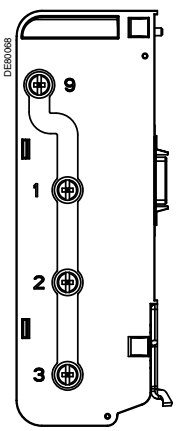
MT10490



Connecting and Assembling the CCA630 Connector

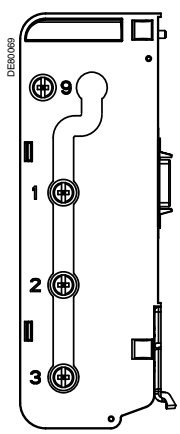
1 Open the two side shields for access to the connection terminals. The shields can be removed to make wiring easier. If removed, replace them after wiring.
2 Remove the bridging strap linking terminals 1, 2, and 3. This strap is supplied with the CCA630.
3 Connect the wires using 4 mm (0.16 in) ring lugs and check the tightness of the six screws that guarantee the continuity of the CT secondary circuits. The connector accommodates wires with cross-sections of 1.5 to 6 mm² (AWG 16-10).
4 Close the side shields.
5 Plug the connector into the 9-pin inlet on the rear panel (item (B)).
6 Tighten the two CCA630 connector fastening screws on the rear panel of Sepam™.

DE90068



Bridging terminals 1, 2, 3, and 9

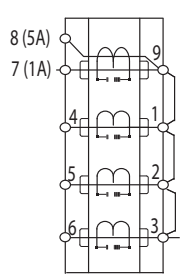
DE90069



Bridging terminals 1, 2, and 3

Connecting and Assembling the CCA634 Connector

1 Open the two side shields for access to the connection terminals. The shields can be removed, if necessary, to make wiring easier. If removed, replaced them after wiring.
2 According to the wiring required, remove or reverse the bridging strap. This is used to link either terminals 1, 2, and 3, or terminals 1, 2, 3, and 9 (see picture opposite).
3 Use terminal 7 (1A) or 8 (5A) to measure the residual current according to the CT secondary.
4 Connect the wires using 4 mm (0.16 in) ring lugs and check the tightness of the six screws that guarantee the continuity of the CT secondary circuits. The connector accommodates wires with cross-sections of 1.5 to 6 mm² (AWG 16-10). The wires only exit from the base.
5 Close the side shields.
6 Insert the retaining tabs into the slots on the base unit.
7 Pivot the connector toward the unit to plug it into the 9-pin SUB-D connector (principle similar to that of the MES module).
8 Tighten the mounting screw.



CCA634

⚠ CAUTION

HAZARD OF IMPROPER OPERATION

Do not use a CCA634 on connector B1 and residual current input Ir on connector E (terminals 14 and 15) simultaneously.

- Though unconnected to a sensor, a CCA634 on connector B1 will disturb input Ir on connector E.

Do not use a CCA634 on connector B2 and residual current input I'r on connector E (terminals 17 and 18) simultaneously.

- Though unconnected to a sensor, a CCA634 on connector B2 will disturb input I'0 on connector E.

Failure to follow this instruction can cause equipment damage.

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Function

Low Power Current Transducer (LPCT) type sensors are voltage-output sensors that comply with IEC 60044-8.

The Square D range of LPCTs includes the following sensors:

CLP1
CLP2
CLP3
TLP160
TLP190.

CCA671 Connector

Function

Three LPCT sensors connect to the CCA671 on the rear panel of Sepam™. The CCA671 changes inputs from the LPCTs into a low level signal scale based on the Full Load Amps (FLA) for each phase.

Description

1 There are three blocks of microswitches that set the CCA671 to the rated phase current value.
2 Microswitch setting/selected rated current equivalency table (two In values per position).
3 There are three RJ45 radial plugs to connect the LPCT sensors.
4 9-pin sub-D connector to connect test equipment (ACE917 for direct connector or via CCA613).

Rating

The CCA671 connector is rated according by the rated primary current **IN**, and measured by the LPCT sensors. **IN** is the current value that corresponds to the rated secondary current of 22.5 mV. The possible settings for IN (in amps) are: 25, 50, 100, 125, 133, 200, 250, 320, 400, 500, 630, 666, 1000, 1600, 2000, 3150.
The selected IN value should be:

- entered as a Sepam™ general setting

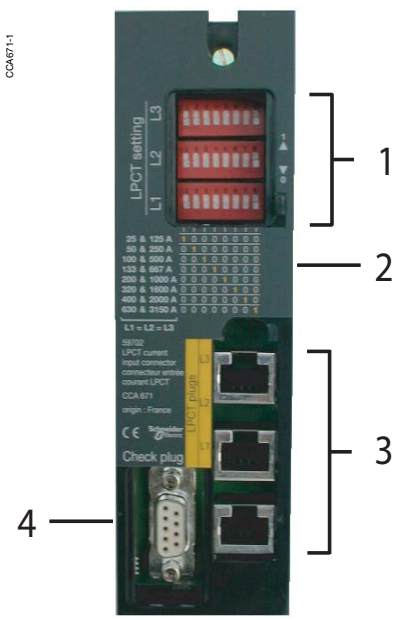
  and

- configured by microswitch on the CCA670/CCA671 connector.

Operating Mode:

1 Use a screwdriver to remove the shield located in the "LPCT settings" zone; the shield protects three blocks of eight microswitches marked L1, L2, L3.
2 On the L1 block, set the microswitch for the selected rated current to "1" (two IN values per microswitch).
   - The table of equivalencies between the microswitch settings and the selected rated current IN is printed on the connector
   - Leave the other microswitches set to "0"
3 Set the other two blocks of switches L2 and L3 to the same position as the L1 block and close the shield.

CCA671-1



Radial plugs for Sepam™ Series 80 (item 3)

CAUTION

HAZARD OF NON-OPERATION

- Set the microswitches for the CCA671 connector before commissioning the device.
- Check that only one microswitch is in position 1 for each block L1, L2, L3, and that no microswitch is in the center position.
- Check that the microswitch settings on all three blocks are identical.

Sepam™ will go into a fail-safe mode if all three LPCT sensors are not connected. Failure to follow these instructions can cause incorrect operation.

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LPCT Type Current Sensors
Test Accessories

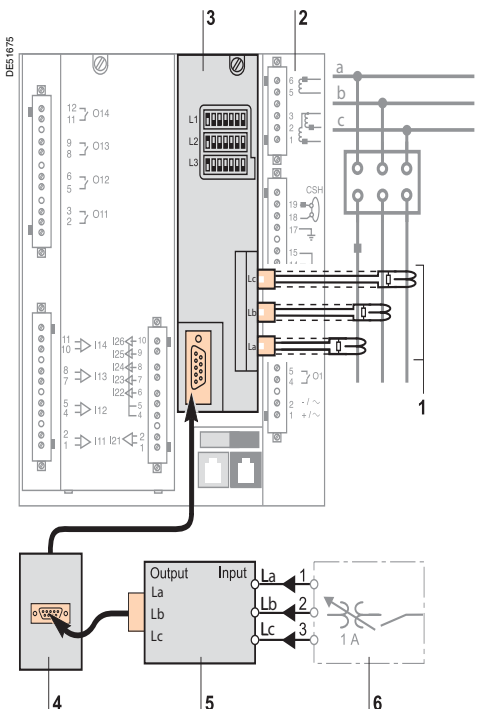
Accessory Connection Principle

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.

Failure to follow these instructions will result in death or serious injury.



The following describes the connections shown at left:

1 The LPCT sensor is equipped with a shielded cable fitted with a yellow RJ45 radial plug that is plugged directly into the CCA671 connector.

2 Sepam™ protection unit.

3 CCA671 connector, LPCT voltage interface, with microswitch setting of rated current.[1]

4 CCA613 remote test plug, flush-mounted on the front of the cubicle and equipped with a 3-meter (9.8 ft) cord to be plugged into the test plug of the CCA670/CCA671 interface connector (9-pin sub-D).

5 ACE917 injection adapter, to test the LPCT protection chain with a standard injection box.

6 Standard injection box.

Note :

1 ***Radial plugs for Sepam™ Series 80***

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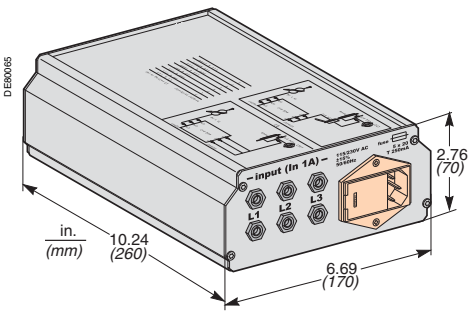
LPCT Type Current Sensors
Test Accessories



ACE917 Injection Adapter

Function

The ACE917 adapter is used to test the protection chain with a standard injection box when Sepam™ is connected to LPCT sensors.

The ACE917 adapter is inserted between:

- the standard injection box
- the LPCT test plug is either:
  - integrated in the Sepam™ CCA671 interface connector
  - transferred by means of the CCA613 accessory

The following are supplied with the ACE917 injection adapter:

- power supply cord
- 3-meter (9.8 ft) cord to connect the ACE917 to the LPCT test plug on CCA671 or CCA613

Characteristics

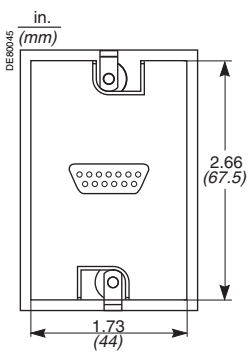
Power supply	115/230 V AC
Protection by time-delayed fuse 5 mm x 20 mm (0.2 x 0.79 in)	0.25 A rating

CCA613 Remote Test Plug

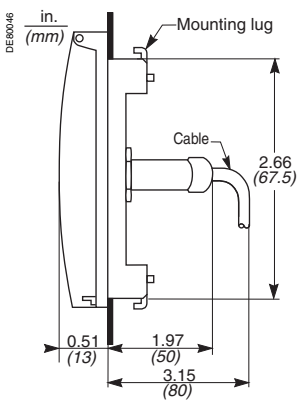
Function

The CCA613 test plug flush-mounts on the front of the cubicle. It has a 3-meter (9.8 ft) cord that transfers data from the test plug integrated in the CCA671 interface connector on the rear panel of Sepam™.

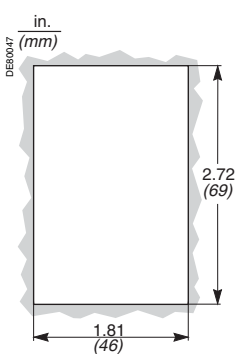
Dimensions



Front view with cover lifted



Right side view



Cut-out

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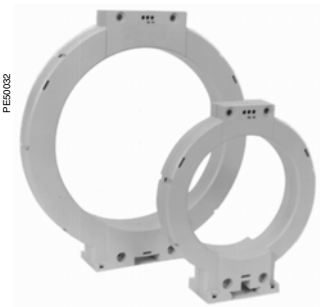
CSH120 & CSH200
Zero Sequence CT

PE50032



CSH120 and CSH200 Zero Sequence CTs.

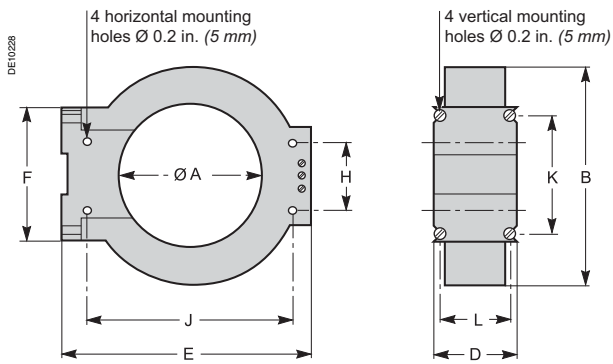
Function

The specifically designed CSH120 and CSH200 zero sequence CTs measure direct residual current. The only difference between them is the diameter. Due to their low voltage insulation, they are used only on cables.

Characteristics

	CSH120	CSH200
Inner diameter	120 mm (4.7 in)	200 mm (7.9 in)
Weight	0.6 kg (1.32 lb)	1.4 kg (3.09 lb)
Accuracy	±5% at 20°C (68°F)	
	±6% max. from –25°C to 70°C (–13°F to +158°F)	
Transformation ratio	1/470	
Maximum permissible current	20 kA - 1 s	
Operating temperature	–25°C to +70°C (–13°F to +158°F)	
Storage temperature	–40°C to +85°C (–40°F to +185°F)	

Dimensions



Dimensions	A	B	D	E	F	H	J	K	L
CSH120	120	164	44	190	76	40	166	62	35
(in)	(4.75)	(6.46)	(1.73)	(7.48)	(2.99)	(1.57)	(6.54)	(2.44)	(1.38)
CSH200	200	256	46	274	120	60	257	104	37
(in)	(7.87)	(10.1)	(1.81)	(10.8)	(4.72)	(2.36)	(10.1)	(4.09)	(1.46)

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CSH120 & CSH200 Zero Sequence CT

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Only CSH120, CSH200, and CSH280 zero sequence CTs are used for direct residual current measurement. Other residual current sensors require the use of an intermediate device, CSH30, ACE990 or CCA634.
- Install the zero sequence CTs on insulated cables.
- Cables with a rated voltage of more than 1000 V must also have a grounded shielding.

Failure to follow these instructions will result in death or serious injury.

CAUTION

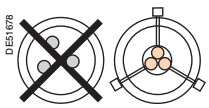
HAZARD OF NON-OPERATION

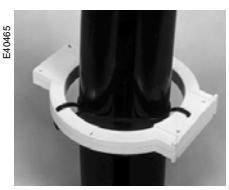
Do not connect the secondary circuit of the CSH zero sequence CTs to ground.
This connection is made in Sepam™.

Failure to follow this instruction can cause Sepam™ to operate incorrectly.

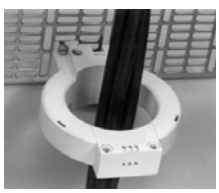
Assembly

1 Group the MV cable(s) in the middle of the zero sequence CT.
2 Use non-conductive binding to hold the cables.
3 Insert the three medium voltage cable shielded grounding cables through the zero sequence CT.





Assembly on MV cables.



Assembly on mounting plate.

Connection

Connection to Sepam™ Series 80

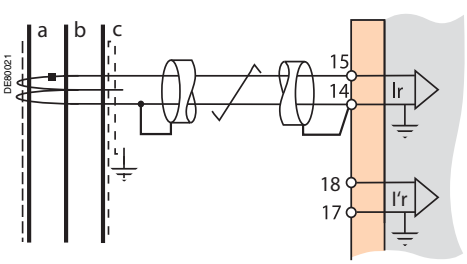
- To residual current Ir input, on connector (E), terminals 15 and 14 (shielding)
- To residual current I'r input, on connector (E), terminals 18 and 17 (shielding)

Recommended Cable

- Sheathed cable, shielded by tinned copper braid
- Minimum cable cross-section 0.93 mm² (AWG 18)
- Resistance per unit length < 100 mΩ/m (30.5 mΩ/ft)
- Minimum dielectric strength: 1000 V (700 Vrms)
- Connect the cable shielding in the shortest manner possible to Sepam™
- Flatten the connection cable against the metal frames of the cubicle.

The connection cable shielding is grounded in Sepam™. Do not ground the cable by any other means.

The maximum resistance of the Sepam™ connection wiring must not exceed 4 Ω (20 m maximum for 100 mΩ/m or 66 ft maximum for 30.5 mΩ/ft).



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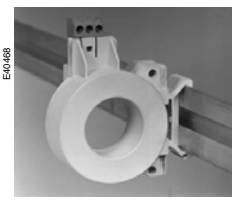
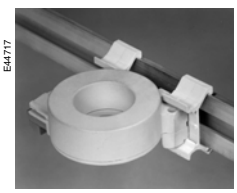
CSH30 Interposing Ring CT

E40468



Vertical assembly of CSH30 interposing ring CT

E44717



Horizontal assembly of CSH30 interposing ring CT

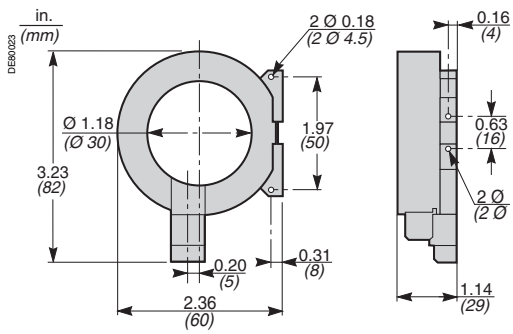
Function

The CSH30 interposing ring CT serves as an interface when measuring residual current using 1A or 5A current transformers.

Characteristics

Weight	0.12 kg (0.265 lb)
Assembly	On symmetrical DIN rail In vertical or horizontal position

Dimensions



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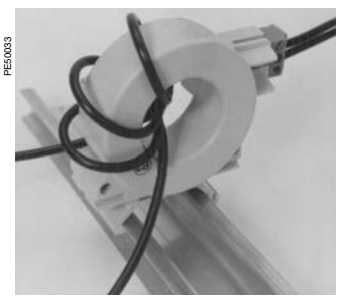
Connection

The CSH30 is adapted for the type of current transformer by the number of turns of the secondary wiring through the CSH30 interposing ring CT:

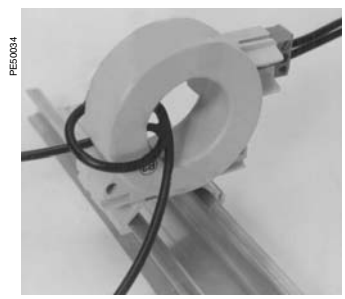
- 5A rating: 4 turns
- 1A rating: 2 turns

5A secondary circuit connection

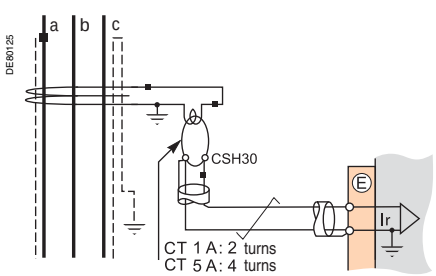


1 Plug into the connector.
2 Insert the transformer secondary wire through the CSH30 interposing ring CT four times.

1A secondary circuit connection



1 Plug into the connector.
2 Insert the transformer secondary wire through the CSH30 interposing ring CT two times.



Connection to Sepam™ Series 80

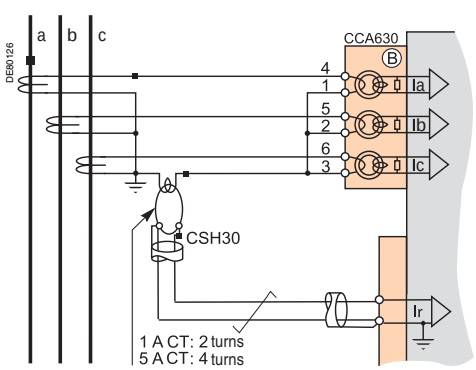
- To residual current Ir input, on connector (E), terminals 14 and 15 (shielding)
- To residual current I'r input, on connector (E), terminals 17 and 18 (shielding)

Recommended Cable

- Sheathed cable, shielded by tinned copper braid
- Minimum cable cross-section: 0.93 mm² (AWG 18) (max. 2.5 mm², AWG 12)
- Resistance per unit length: less than 100 mΩ/m (30.5 mΩ/ft)
- Minimum dielectric strength: 1000 V (700 Vrms)
- Maximum length: 2 m (6.6 ft).

The CSH30 interposing ring CT must be installed near Sepam™ (Sepam™ - CSH30 link less than two meters (6.6 ft) long).

Flatten the connection cable against the metal frames of the cubicle. The connection cable shielding is grounded in Sepam™. Do not ground the cable by any other means.



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1

PE50037

ACE990 zero sequence CT interface

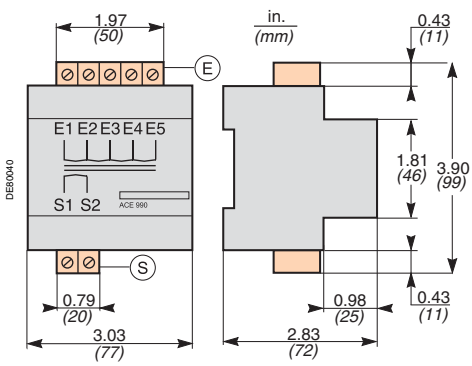
Function

The ACE990 adapts measurements between an MV zero sequence CT with a ratio of 1/n (50 ≤ n ≤ 1500), and the Sepam™ residual current input.

Characteristics

Weight	0.64 kg (1.41 lb)
Assembly	Mounted on symmetrical DIN rail
Amplitude accuracy	±1%
Phase accuracy	< 2°
Maximum permissible current	20 kA - 1 s (on the primary winding of an MV zero sequence CT with a ratio of 1/50 that does not saturate)
Operating temperature	–5°C to +55°C (+23°F to +131°F)
Storage temperature	–25°C to +70°C (–13°F to +158°F)

DE80040



Description and Dimensions

(E) ACE990 input terminal block, for connection of the zero sequence CT.

(S) ACE990 output terminal block, for connection of the Sepam™ residual current.

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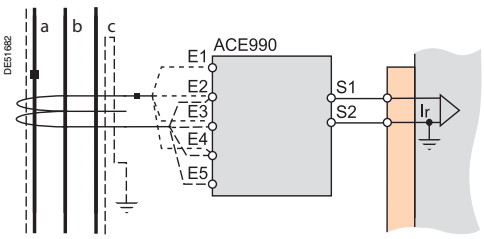
ACE990 Zero Sequence CT Interface



Connection

Connecting a Zero Sequence CT

Connect only one zero sequence CT to the ACE990 interface.

The secondary circuit of the MV zero sequence CT connects to two of the five ACE990 interface input terminals. To define the two input terminals, you must know:

- Zero sequence CT ratio (1/n)
- Zero sequence CT power
- Close approximation of rated current INr
  (**INr** is a general setting in Sepam™ and defines the ground fault protection setting
  range between 0.1 and 15 INr)

The table below is used to determine:

- the two ACE990 input terminals to connect to the MV zero sequence CT secondary
- the type of residual current sensor to set
- the exact value of the rated residual current *INr* setting, given by the following formula: **INr = k x number of zero sequence CT turns**
  with k the factor defined in the table below

The zero sequence CT must connect to the interface in the right direction for correct operation. The MV zero sequence CT secondary output terminal S1 must connect to the terminal with the lowest index (Ex).

K Value	ACE990 Input Terminals to be Connected	Residual Current Sensor Setting	Min. MV Zero Sequence CT Power
0.00578	E1 - E5	ACE990 - range 1	0.1 VA
0.00676	E2 - E5	ACE990 - range 1	0.1 VA
0.00885	E1 - E4	ACE990 - range 1	0.1 VA
0.00909	E3 - E5	ACE990 - range 1	0.1 VA
0.01136	**E2 - E4**	**ACE990 - range 1**	**0.1 VA**
0.01587	E1 - E3	ACE990 - range 1	0.1 VA
0.01667	E4 - E5	ACE990 - range 1	0.1 VA
0.02000	E3 - E4	ACE990 - range 1	0.1 VA
0.02632	E2 - E3	ACE990 - range 1	0.1 VA
0.04000	E1 - E2	ACE990 - range 1	0.2 VA
0.05780	E1 - E5	ACE990 - range 2	2.5 VA
0.06757	E2 - E5	ACE990 - range 2	2.5 VA
0.08850	E1 - E4	ACE990 - range 2	3.0 VA
0.09091	E3 - E5	ACE990 - range 2	3.0 VA
0.11364	E2 - E4	ACE990 - range 2	3.0 VA
0.15873	E1 - E3	ACE990 - range 2	4.5 VA
0.16667	E4 - E5	ACE990 - range 2	4.5 VA
0.20000	E3 - E4	ACE990 - range 2	5.5 VA
0.26316	E2 - E3	ACE990 - range 2	7.5 VA

Example:
Given a zero sequence CT with a ratio of 1/400 2 VA, used within a measurement range of 0.5 A to 60 A.

How should it be connected to Sepam™ via the ACE990?
1. *Choose a close approximation of the rated current In0, 5 A.*
2. *Calculate the ratio:*
   approx. In0/number of turns = 5/400 = 0.0125.
3. *Find the closest value of k in the table opposite to k = 0.01136.*
4. *Check the mininum power required for the zero sequence CT:*
   2 VA zero sequence CT > 0.1 VA V OK.
5. *Connect the zero sequence CT secondary to ACE990 input terminals E2 and E4.*
6. *Set Sepam™ up with:*
   INr = 0.0136 x 400 = 4.5 A.

This value of In0 can be used to monitor current between 0.45 A and 67.5 A.

Wiring of MV zero sequence CT secondary circuit:
- *MV zero sequence CT S1 output to ACE990 E2 input terminal*
- *MV zero sequence CT S2 output to ACE990 E4 input terminal.*

Connection to Sepam™ Series 80
- To residual current Ir input, on connector (E), terminals 14 and 15 (shielding)
- To residual current I'r input, on connector (E), terminals 17 and 18 (shielding)

Recommended cables
- Cable between zero sequence CT and ACE990: less than 50 m (160 ft) long
- Sheathed cable shielded by tinned copper braid between the ACE990 and Sepam™: maximum length 2 m (6.6 ft)
- Cable cross-section between 0.93 mm² (AWG 18) and 2.5 mm² (AWG 12)
- Resistance per unit length: less than 100 mΩ/m (30.5 mΩ/ft)
- Minimum dielectric strength: 100 Vrms.

Follow these steps to connect the cable.
1 Connect the connection cable shielding in the shortest manner possible (2 cm or 5.08 in maximum) to the shielding terminal on the Sepam™ connector.
2 Flatten the connection cable against the metal frames of the cubicle. The connection cable shielding is already grounded in Sepam™. **Do not ground the cable by any other means**.

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Voltage Transformers

Function

Sepam™ connects to any standard voltage transformer with a rated secondary voltage of 100 V to 240 V.

Square D offers a range of voltage transformers

- to measure phase-to-neutral voltages: VT's with one insulated MV terminal
- to measure phase-to-phase voltages: VT's with two insulated MV terminals
- with or without integrated protection fuses

Contact a Square D representative for more information.

Connection

Main Voltage Inputs

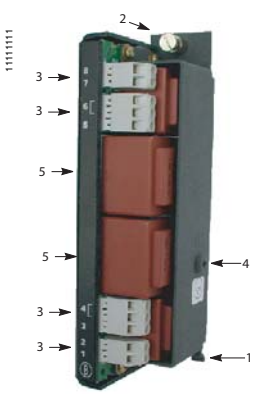
All Sepam™ Series 80 units have four main voltage inputs to measure four voltages (three phase voltages and a residual voltage).

- The main voltage measurement VTs are connected to the Sepam™ connector (E). (see page 20)
- Four transformers integrated in the Sepam™ base unit provide the required impedance matching and isolation between the VTs and the Sepam™ input circuits

Additional Voltage Inputs

Sepam™ B83 units also have four additional voltage inputs to measure the voltages on a second set of bus.

- The additional voltage measurement VTs connect to the CCT640, which is mounted on the Sepam™ port (B2) (see page 20).
- Four transformers in the CCT640 provide impedance matching and isolation between the VTs and the Sepam™ input circuits (port (B2)). (see page 20).



CCT640 Connector

Function

The CCT640 connects the four additional voltages available in Sepam™ B83. It provides impedance matching and isolation between the Voltage Transformers and the Sepam™ input circuits, port (B2) (see page 20).

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⚠ DANGER

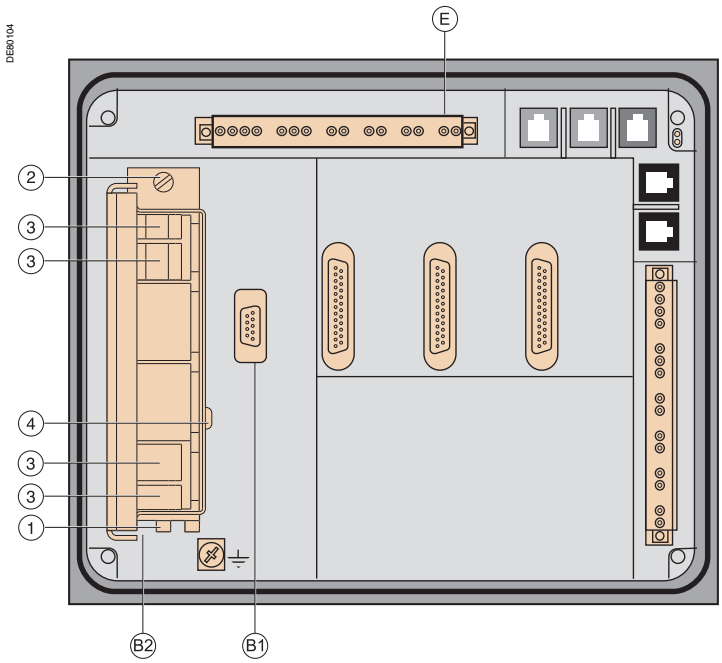
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

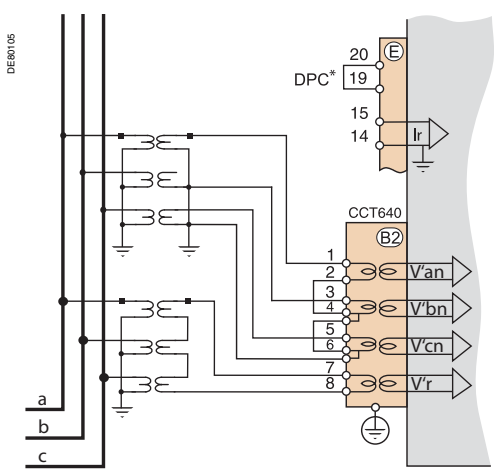
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Tighten all terminal screws, even those not in use.

Failure to follow these instructions will result in death or serious injury.

Assembly

1 Insert the three connector pins into the slots ① on the base unit.
2 Rotate connector to plug it into the 9-pin SUB-D connector
3 Tighten the mounting screw ②.





Connection

Make the connections to the screw-type connectors on the rear panel of the CCT640 (item ③ above).

Wiring without Fittings

- One wire with maximum cross-section 0.2 to 2.5 mm² (≤• AWG 24-12) or two wires with maximum cross-section 0.2 to 1 mm² (≥ AWG 24-16)
- Stripped length: 8 to 10 mm (0.31 to 0.39 in)

Wiring with Fittings

Recommended wiring with Telemecanique fittings:

- DZ5CE015D for one 1.5 mm² wire (AWG 16)
- DZ5CE025D for one 2.5 mm² wire (AWG 12)
- AZ5DE010D for two 1 mm² wires (AWG 18)
- Tube length: 8.2 mm (0.32 in)
- Stripped length: 8 mm (0.31 in)
- Tightening torque: 6.1 to 8.8 in-lb (0.7 to 1 Nm)

Grounding

The CCT640 must be grounded by connection (green/yellow wire and ring lug) to the screw ④ This is a safety measure in case the CCT640 disconnects.

** Detection of Plugged Connector (required for proper operation. Installed manually)*

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MES120, MES120G, MES120H 14 Input/6 Output Modules

PE50020

MES120 14 input / 6 output module.

Function

You can extend the five output relays included on the Sepam™ Series 80 base unit by adding one, two, or three MES120 modules with 14 DC logic inputs and six output relays, one control relay output, and five annunciation relay outputs.

Three modules are available for the different input supply voltage ranges and offer different switching thresholds:

- MES120, 14 inputs 24 V DC to 250 V DC with a typical switching threshold of 14 V DC
- MES120G, 14 inputs 220 V DC to 250 V DC with a typical switching threshold of 155 V DC
- MES120H, 14 inputs 110 V DC to 125 V DC with a typical switching threshold of 82 V DC

Characteristics

MES120/MES120G/MES120H Modules					
Weight		0.38 kg (0.83 lb)			
Operating temperature		–25°C to +70°C (–13°F to +158°F)			
Environmental characteristics		Same characteristics as Sepam™ base units (see page 21)			
Logic Inputs		**MES120**	**MES120G**	**MES120H**	
Voltage		24 to 250 V DC	220 to 250 V DC	110 to 125 V DC	
Range		19.2 to 275 V DC	170 to 275 V DC	88 to 150 V DC	
Typical burden		3 mA	3 mA	3 mA	
Typical switching threshold		14 V DC	155 V DC	82 V DC	
Input limit voltage	At state 0	< 6 V DC	< 144 V DC	< 75 V DC	
	At state 1	> 19 V DC	> 170 V DC	> 88 V DC	
Isolation of inputs from other isolated groups		Enhanced	Enhanced	Enhanced	
Control Relay Output Ox01*					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		8 A	8 A	8 A	8 A
Breaking capacity	Resistive load	8/4 A	0.7 A	0.3 A	8 A
	Load L/R < 20 ms	6/2 A	0.5 A	0.2 A	
	Load L/R < 40 ms	4/1 A	0.2 A	0.1 A	
	Load p.f. > 0.3				5 A
Making capacity		< 30 A for 200 ms			
Isolation of outputs from other isolated groups		Enhanced			
Annunciation Relay Output Ox02 to Ox06					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		2 A	2 A	2 A	2 A
Breaking capacity	Load L/R < 20 ms	2/1 A	0.5 A	0.15 A	
	Load p.f. > 0.3				1 A
Isolation of outputs from other isolated groups		Enhanced			

** Ox01 denotes module number of I/O. For example, the first output of module #2 is O201. See page 22 of this manual.*

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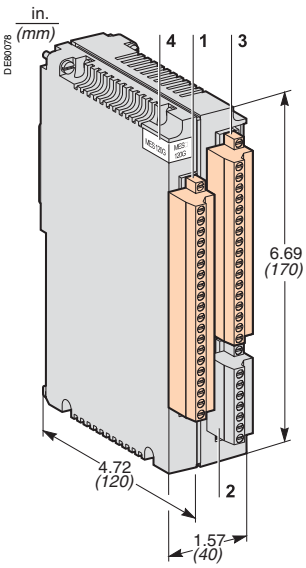
MES120, MES120G, MES120H
14 Input/6 Output Modules
Installation



Installation of the second MES120 module, connected to base unit connector H2

Description

There are three removable, lockable screw-type connectors.

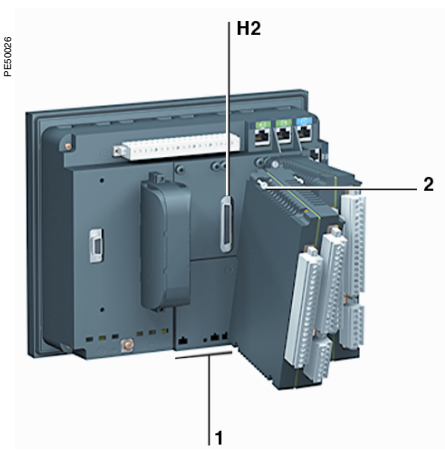
1 20-pin connector for nine logic inputs:
- Ix01 to Ix04: four independent logic inputs
- Ix05 to Ix09: five common point logic inputs

2 7-pin connector for five common point logic inputs Ix10 to Ix14.

3 17-pin connector for six relay outputs:
- Ox01: one control relay output
- Ox02 to Ox06: five annunciation relay outputs.

Addressing of MES120 module inputs / outputs:
- x = 1 for the module connected to H1
- x = 2 for the module connected to H2
- x = 3 for the module connected to H3.

4 MES120G, MES120H identification label (MES120 modules have no labels).



Installation of the second MES120 module, connected to base unit connector H2

Assembly

Installation of an MES120 Module on the Base Unit

1 Insert the two pins on the MES module into the slots **(1)** on the base unit.
2 Push the module flat up against the base unit to plug it into the connector **(H2).**
3 Partially tighten the two mounting screws **(2)** before locking them.
4 For the MES120, if only one module is required, connect it to connector **(H1)** as shown.
5 If two modules are required, connect them to connectors **(H1**) and **(H2).**
6 If three modules are required (maximum configuration), the three connectors **H1**, **H2** and **H3** are used.

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MES120, MES120G, MES120H 14 Input/6 Output Modules
Installation

Connection

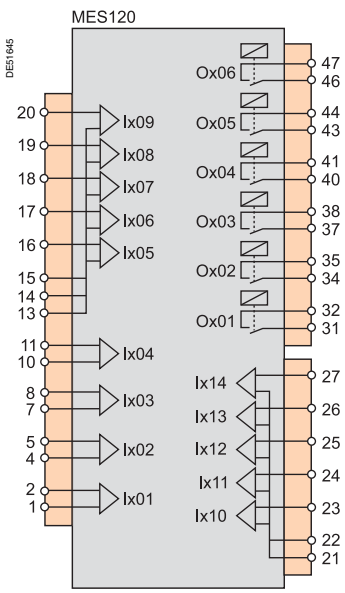
The inputs are potential-free and the DC power supply source is external from the relay base unit.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.



Connector Wiring

Wiring without fittings:

- one wire with maximum cross-section 0.2 to 2.5 mm² (≥ AWG 24-12)
- two wires with maximum cross-section 0.2 to 1 mm² (≥ AWG 24-16)
- stripped length: 8 to 10 mm (0.31 to 0.39 in)

Wiring with fittings:

- Recommended wiring with Telemecanique fittings:
  - DZ5CE015D for one 1.5 mm² wire (AWG 16)
  - DZ5CE025D for one 2.5 mm² wire (AWG 12)
  - AZ5DE010D for two 1 mm² wires (AWG 18)
- tube length: 8.2 mm (0.32 in)
- stripped length: 8 mm (0.31 in)
- Tightening torque: 6.1 to 8.8 in-lb (0.7 to 1 Nm)

** Ox01 denotes module number of I/O. For example, the first output of module #2 is O201. See page 22 of this manual.*

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Remote Modules

Selection Guide

Four remote modules are options to enhance the Sepam™ base unit functions:

- The number and type of remote modules compatible with the base unit depend on the Sepam™ application
- The DSM303 remote advanced UMI module is only compatible with base units that do not have integrated advanced UMIs

Sepam™ Series 80					
Item	**Description**	**Comments**	**S8x, B8x**	**T8x, G8x**	**M8x C8x**
MET1482	Temperature sensor module	See page 48	0	2	2
MSA141	Analog output module	See page 50	1	1	1
DSM303	Remote advanced UMI module	See page 52	1	1	1
MCS025	Sync-check module	See page 54	1	1	0
Number of sets of interlinked modules / maximum number of remote modules			Five modules split between two sets of interlinked modules		

Connection

Connection Cables

Different combinations of modules can be connected using cables fitted with two black RJ45 connectors that come in three lengths:

- CCA770: length = 2 ft (0.6 m)
- CCA772: length = 6.6 ft (2 m)
- CCA774: length = 13.1 ft (4 m)

The modules are linked by cables which provide power and act as functional links with the Sepam™ unit (connector (D) to connector (Da), (Dd) to (Da), …).

Rules on Inter-Module Linking

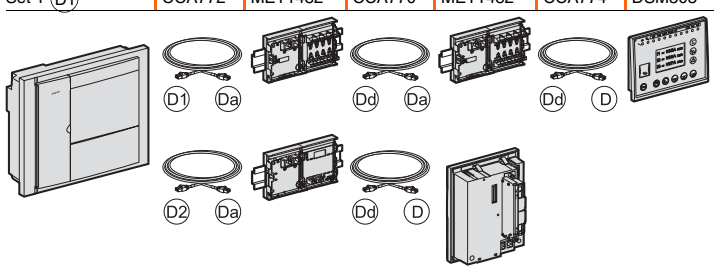
1 *Link no more than three modules*
2 *Connect DSM303 or MCS025 modules only at the end of the link*

Maximum Advisable Configurations

Sepam™ Series 80: Two Sets of Interlinked Modules

Sepam™ Series 80 has two connection ports for remote modules, (D1) and (D2). Modules may be connected to either port.

Base	Cord	Module 1	Cord	Module 2	Cord	Module 3
Set 1 (D1)	CCA772	MET1482	CCA770	MET1482	CCA774	DSM303
Set 2 (D2)	CCA772	MSA141	CCA785	MCS025	-	-



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CAUTION

HAZARD OF NON-OPERATION

The MCS025 module must ALWAYS use the special CCA785 cord supplied with the module. It has an orange RJ45 plug and a black RJ45 plug.

Failure to follow this instruction can cause equipment damage.

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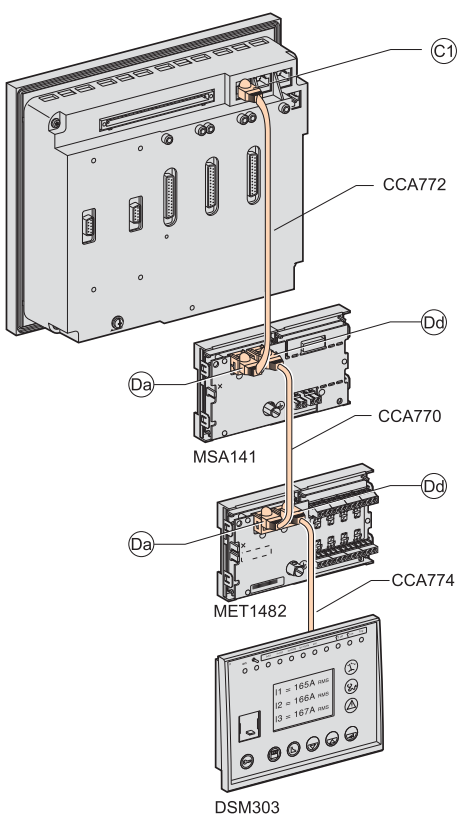

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MET1482
Temperature Sensor Module

PE50021

Function

The MET1482 module can connect eight temperature sensors (RTDs) of the same type:

- Pt100, Ni100, or Ni120 type RTDs, according to parameter setting
- Three-wire temperature sensors
- Two modules for each Sepam™ Series 80 base unit, connected by CCA770 (2 ft or 0.6 m), CCA772 (6.6 ft or 2 m), or CCA774 (13.1 ft or 4 m) cables

The temperature measurement (for example, in a transformer or motor winding) provides for:

- thermal overload (to take ambient temperature into account)
- temperature monitoring

Characteristics

MET1482 Module		
Weight	0.441 lb (0.2 kg)	
Assembly	On symmetrical DIN rail	
Operating temperature	–13°F to +158°F (–25°C to +70°C)	
Environmental characteristics	Same characteristics as Sepam™ base units	
Temperature Sensors	**Pt100**	**Ni100/Ni120**
Isolation from ground	None	None
Current injected in RTD	4 mA	4 mA

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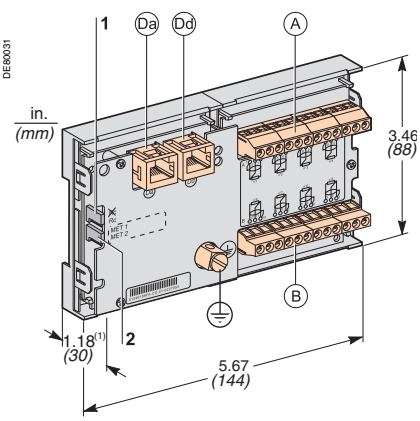

(1) *70 mm (2.8 in) with CCA77x cord connected*

Description and Dimensions

(A) Terminal block for RTDs 1 to 4
(B) Terminal block for RTDs 5 to 8
(Da) RJ45 connector to connect the module to the base unit with a CCA77x cord
(Dd) RJ45 connector to link up the next remote module with a CCA77x cord (according to application)
(⏚) Grounding terminal

1 The jumper for impedance matching with load resistor (Rc) is set to:
- ~~Rc~~, if the module is not the last interlinked module (default position)
- Rc, if the module is the last interlinked module

2 The jumper used to select module number is set to:
- **MET1**: first MET1482 module, to measure temperatures T1 to T8 (default position)
- **MET2**: second MET1482 module, to measure temperatures T9 to T16 (for Sepam™ Series 40 and Series 80 only)

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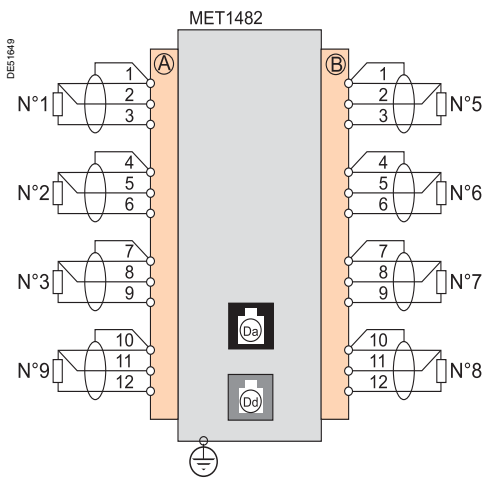
Connection

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Isolate the temperature sensors from dangerous voltages.

Failure to follow these instructions will result in death or serious injury.



Connecting the Ground Terminal

Use a tinned copper braid with a cross-section ≥ 6 mm² (AWG 10) or cable with a cross-section ≥ 2.5 mm² (AWG 12) and length ≤ 200 mm (7.9 in), fitted with a 4 mm (0.16 in) ring lug.

Check the tightness. The maximum tightening torque is 19.5 in-lb (2.2 Nm).

Connection of RTDs to Screw-Type Connectors

- One wire with cross-section 0.2 to 2.5 mm² (AWG 24-12); or
- Two wires with cross-section 0.2 to 1 mm² (AWG 24-18)

The recommended cross-sections according to distance:

- Up to 100 m (330 ft) ≥ 1 mm² (AWG 18)
- Up to 300 m (990 ft) ≥ 1.5 mm² (AWG 16)
- Up to 1 km (0.62 mi) ≥ 2.5 mm² (AWG 12)

Maximum distance between sensor and module: 1 km (0.62 mi)

Wiring Precautions

- Use shielded cables whenever possible.
  Unshielded cables can cause measurement errors that vary in degree according to the level of surrounding electromagnetic disturbance
- Connect the shielding only at the MET1482 end, in the shortest manner possible to the corresponding terminals of connectors Ⓐ and Ⓑ
- Do not connect the shielding at the RTD end.

Accuracy Derating According to Wiring

The error Δt is proportional to the length of the cable and inversely proportional to the cable cross-section:

$$\Delta t(°C) = 2 \times \frac{L(km)}{S(mm^2)}$$

- ±2.1°C/km for 0.93 mm² cross-section (AWG 18)
- ±1°C/km for 1.92 mm² cross-section (AWG 14).

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MSA141
Analog Output Module

M11009

MSA141 Analog Output Module

Function

The MSA141 module converts one of the Sepam™ measurements into an analog signal:

- Measurement selection is by parameter setting
- 0-10 mA, 4-20 mA, or 0-20 mA analog signal according to parameter setting
- To scale the analog signal, set minimum and maximum values of the converted measurement
  Example: the setting used to have phase current *Ia* as a 0-10 mA analog output with a dynamic range of 0 to 300 A is:
  - minimum value = 0
  - maximum value = 300 (3000 * 0.1A = 300.0 A)
- Any one of the CCA770 (0.6 m or 2 ft), CCA772 (2 m or 6.6 ft) or CCA774 cables (4 m or 13.1 ft) connects a single module for each Sepam™ base unit

The analog output can also be remotely managed via the communication network.

MSA141 Module	
Weight	0.2 kg (0.441 lb)
Assembly	On symmetrical DIN rail
Operating temperature	–25°C to +70°C (–13°F to +158°F)
Environmental characteristics	Same characteristics as Sepam™ base units
Analog Output	
Current	4-20 mA, 0-20 mA, 0-10 mA
Scaling (no data input checking)	Minimum value
	Maximum value
Load impedance	< 600 Ω (wiring included)
Accuracy	0.5 %

Measurements Available	**Unit**	**Series 20**	**Series 40**	**Series 80**
Phase and residual currents	0.1 A	■	■	■
Phase-to-neutral and phase-to-phase voltages	1 V	■	■	■
Frequency	0.01 Hz	■	■	■
Thermal capacity used	1 %	■	■	■
Temperatures	1°C (1°F)	■	■	■
Active power	0.1 kW		■	■
Reactive power	0.1 kVAR		■	■
Apparent power	0.1 kVA		■	■
Power factor	0.01			■
Remote setting via communication link		■	■	■

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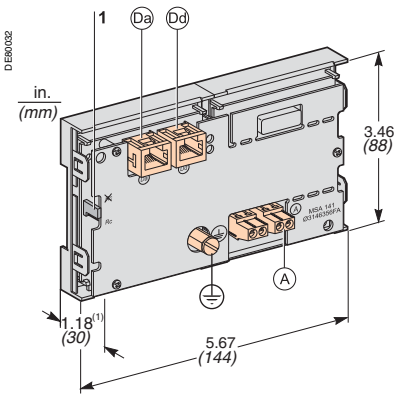
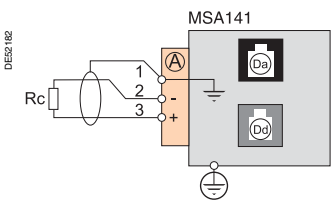
MSA141
Analog Output Module



(1) *70 mm (2.8 in) with CCA77x cord connected*



Description and Dimensions

- (A) Terminal block for analog output
- (Da) RJ45 connector to connect the module to the base unit with a CCA77x cord
- (Dd) RJ45 connector to link up the next remote module with a CCA77x cord (according to application)
- (⏚) Grounding terminal

1 Jumper for impedance matching with load resistor (Rc), to be set to:
- ~~Rc~~, if the module is not the last interlinked module (default position)
- Rc, if the module is the last interlinked module

Connection

Ground Terminal Connection

Use a tinned copper braid with a cross-section ≥ 6 mm² (AWG 10) or a cable with a cross-section ≥ 2.5 mm² (AWG 12) and length ≤ 200 mm (7.9 in), equipped with a 4 mm (0.16 in) ring lug.

Check the tightness. The maximum tightening torque is 19.5 in-lb (2.2 Nm).

Connection of Analog Output to Screw-Type Connector

- One wire with a cross-section 0.2 to 2.5 mm² (AWG 24-12)

  or

- Two wires with a cross-section 0.2 to 1 mm² (AWG 24-16)

Wiring Precautions

- Use shielded cables whenever possible
- Use a tinned copper braid to connect the shielding at the MSA141 end

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely deenergized, tested, and tagged
- Use a properly rated voltage sensing device to confim that power is off.
- Screw tight all terminals, even those not in use.
- Isolate the temperature sensors from dangerous voltages.

Failure to follow these instructions will result in death or serious injury.

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DSM303
Remote Advanced UMI Module

PE50127

DSM303 Remote Advanced UMI Module

Function

The DSM303 offers all the functions available on a Sepam™ integrated advanced user-machine interface (UMI) when used with a Sepam™ that does not have its own advanced UMI.

Install on the front panel of the cubicle in the most suitable operating location:

- Reduced depth < 30 mm (1.2 in)
- A single module for each Sepam™, to be connected by one of the CCA772 (2 m or 6.6 ft) or CCA774 (4 m or 13.1 ft) cables

The module cannot connect to Sepam™ units with integrated advanced UMIs.

Characteristics

DSM303 Module	
Weight	0.661 lb (0.3 kg)
Assembly	Flush-mounted
Operating temperature	–13°F to +158°F (–25°C to +70°C)
Environmental characteristics	Same characteristics as Sepam™ base units

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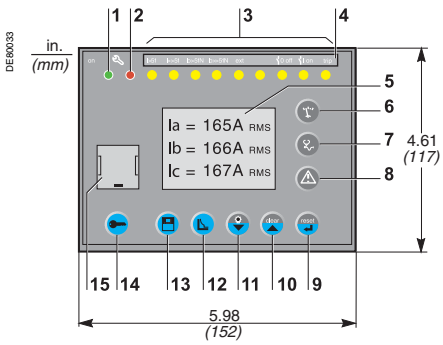
DSM303
Remote Advanced UMI Module

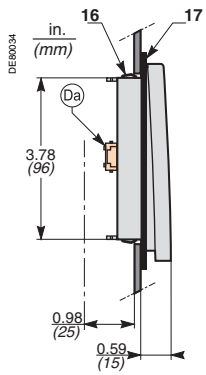
Description and Dimensions

Clips secure the flush-mounted module. It requires no additional screw-type fasteners.

Front View



Side View

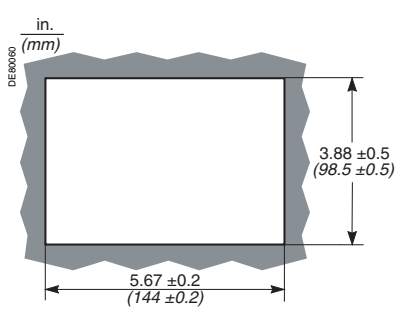


1 Green LED: Sepam™ on
2 Red LED:
- steadily on: module unavailable
- flashing: Sepam™ link unavailable

3 Nine yellow LEDs
4 Label identifying the LEDs
5 Graphic LCD screen
6 Display measurements
7 Display switchgear, network, and machine diagnosis data
8 Display alarm messages
9 Sepam™ reset (or confirm data entry)
10 Alarm acknowledgment and clearing, backlight on, or move cursor up
11 LED test, backlight on, or move cursor down
12 Access to protection settings
13 Access to Sepam™ parameters
14 Entry of 2 passwords
15 PC connection port
16 Mounting clip
17 Gasket to ensure NEMA 12 tightness (gasket supplied with the DSM303 module, to be installed if necessary)

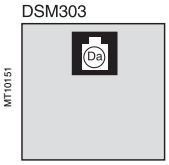
(Da) RJ45 lateral output connector to connect the module to the base unit with a CCA77x cord.

Cut-out for flush-mounting (mounting plate thickness < 3 mm or 0.12 in)



Connection

DSM303



(Da) RJ45 socket connects the module to the base unit with a CCA77x cord.

The DSM303 module is always the last interlinked remote module and it systematically ensures impedance matching by load resistor (Rc).

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MCS025
Sync-Check Module

MCS025 Sync-Check Module

Function

The MCS025 module checks the upstream and downstream voltages of a circuit breaker to ensure safe closing (ANSI 25).

It checks the differences in amplitude, frequency, and phase between the two measured voltages, and takes into account dead line/bus conditions.

Three relay outputs can be used to send a **Close Enable** signal to several Sepam™ Series 80 units.

The circuit-breaker control function of each Sepam™ Series 80 unit takes this close enable into account.

The settings for the sync-check function and the measurements carried out by the module are accessed by the SFT2841 setting and operating software. They are similar to the other settings and measurements for the Sepam™ Series 80.

The MCS025 module is equipped with the following:
- CCA620 connector for connecting the relay outputs and the power supply
- CCT640 connector for voltage connection
- CCA785 cord for connection between the module and the Sepam™ Series 80 base unit

Characteristics

MCS025 Module					
Weight		2.98 lb (1.35 kg)			
Assembly		With the AMT840 accessory (must be ordered separately)			
Operating temperature		–13°F to +158°F (–25°C to +70°C)			
Environmental characteristics		Same characteristics as Sepam™ base units			
Voltage Inputs					
Input impedance		> 100 kΩ			
Burden		< 0.015 VA (VT 100 V)			
Continuous thermal withstand		240 V			
1-second overload		480 V			
Relay Outputs					
Relay Outputs O1 and O2					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		8 A	8 A	8 A	8 A
Breaking capacity	Resistive load	8 A / 4 A	0.7 A	0.3 A	
	Load L/R < 20 ms	6 A / 2 A	0.5 A	0.2 A	
	Load L/R < 40 ms	4 A / 1 A	0.2 A	0.1 A	
	Resistive load				8 A
	Load p.f. > 0.3				5 A
Making capacity		< 30 A for 200 ms			
Isolation of outputs from other isolated groups		Enhanced			
Relay Outputs O3 and O4 (O4 not used)					
Voltage	DC	24 / 48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		2 A	2 A	2 A	2 A
Breaking capacity	Load L/R < 20 ms	2 A / 1 A	0.5 A	0.15 A	
	Load p.f. > 0.3				5 A
Isolation of outputs from other isolated groups		Enhanced			
Power Supply					
Voltage		24 to 250 V DC, -20 % / +10 %		110 to 240 V AC, –20 % / +10 % 47.5 to 63 Hz	
Maximum burden		6 W		9 VA	
Inrush current		< 10 A for 10 ms		< 15 A for one half period	
Acceptable momentary outages		10 ms		10 ms	

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MCS025
Sync-Check Module

Description

1 MCS025 module

Ⓐ CCA620 20-pin connector for:
- Auxiliary power supply
- Four relay outputs
  - O1, O2, O3: close enable
  - O4: not used

Ⓑ CCT640 connector (phase-to-neutral or phase-to-phase) for the two input voltages to be synchronized

Ⓒ RJ45 connector: not used

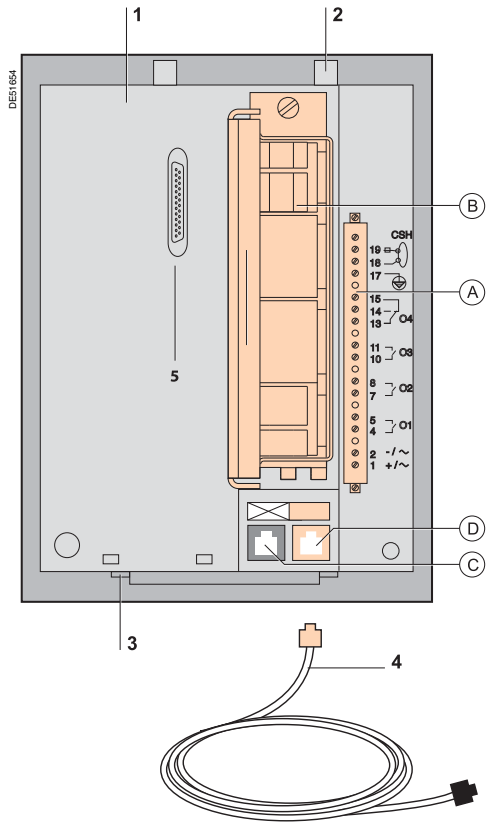
Ⓓ RJ45 connector for module connection to the Sepam™ Series 80 base unit, either directly or via another remote module

2 Two mounting clips

3 Two holding pins for the flush-mount position

4 CCA785 connection cord

5 CCA792 (not used)



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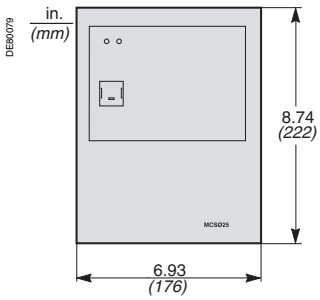
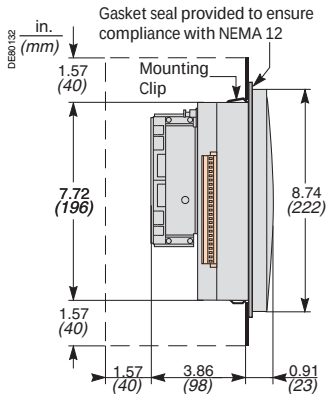
MCS025
Sync-Check Module

Dimensions

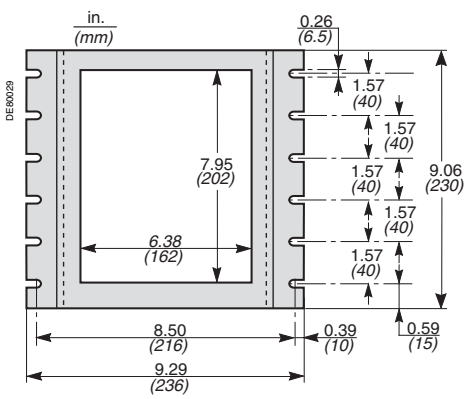


MCS025

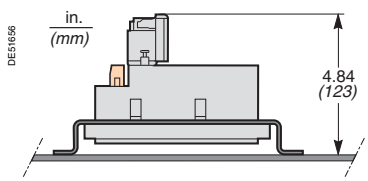


Assembly with AMT840 Mounting Plate

If possible, mount the MCS025 module at the back of the compartment using the AMT840 mounting plate.



AMT840 mounting plate



Connection Characteristics

Connector	Type	Reference	Wiring
(A)	Screw-type	CCA620	■ Wiring with no fittings: □ 1 wire with maximum cross-section 0.2 to 2.5 mm² (> AWG 24-12) or 2 wires with cross-section 0.2 to 1 mm² (>AWG 24-16) □ Stripped length: 8 to 10 mm (0.31 to 0.39 in) ■ Wiring with fittings: □ Recommended wiring with Telemecanique fittings: - DZ5CE015D for 1 wire 1.5 mm² (AWG 16) - DZ5CE025D for 1 wire 2.5 mm² (AWG 12) - AZ5DE010D for 2 x 1 mm² wires (AWG 18) □ Tube length: 8.2 mm (0.32 in) □ Stripped length: 8 mm (0.32 in) ■ Tightening torque: 6.1 to 8.8 in-lb (0.7 to 1.0 Nm)
(B)	Screw-type	CCT640	VT wiring: same as wiring of the CCA620 Ground connection is by 4 mm (0.15 mm) ring lug
(D)	Orange RJ45 connector		CCA785, special prefabricated cord supplied with the MCS025 module: ■ Orange RJ45 connector for connection to port (D) on the MCS025 module ■ Black RJ45 connector for connection to the Sepam™ Series 80 base unit, either directly or via another remote module

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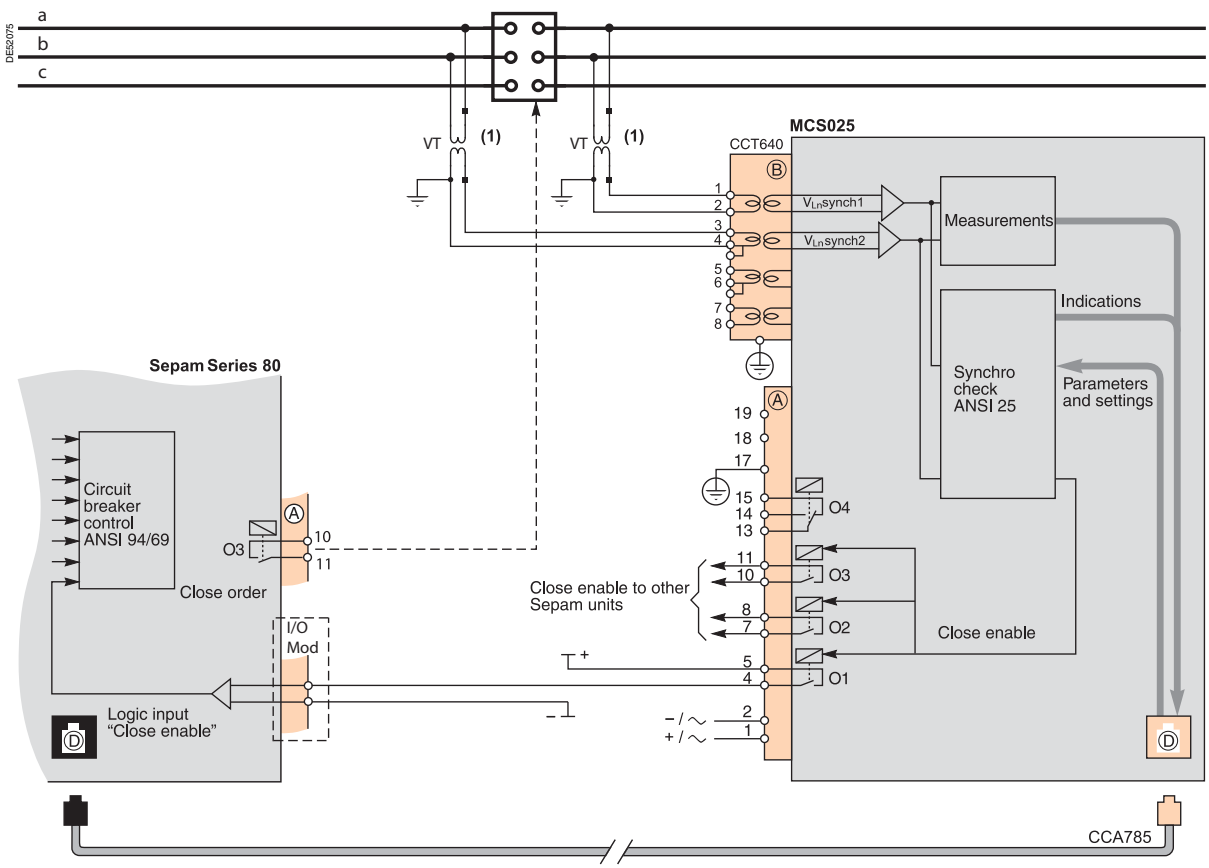
MCS025
Sync-Check Module

Connection Diagram



(1) *Phase-to-phase or phase-to-neutral connection.*

CAUTION

HAZARD OF NON-OPERATION

The MCS025 module must ALWAYS be connected with the special CCA785 cord, supplied with the module and equipped with an orange RJ45 plug and a black RJ45 plug.

Failure to follow this instruction can cause equipment damage.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Isolate the temperature sensors from dangerous voltages.
- Always use a properly rated voltage sensing device to confirm power is off.
- Ground the equipment under test to protective and to functional ground.
- Connect terminal 17 (PE) on connector (A) of the MCS025 module and the functional ground terminal on the Sepam™ Series 80 unit to the local cubicle grounding circuit.
- Keep the two connection points as close as possible to one another.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

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Communication Accessory Selection Guide

There are two types of Sepam™ communication accessories:
- communication interfaces essential for connecting Sepam™ to the communication network
- converters and other optional accessories used to completely implement the communication network

Communication-Interface Selection Guide

		ACE9492	ACE959	ACE937	ACE969TP		ACE969FO	
Type of Network								
		S-LAN or E-LAN (1)	S-LAN or E-LAN (1)	S-LAN or E-LAN (1)	S-LAN	E-LAN	S-LAN	E-LAN
Protocol								
Modbus		■	■	■	■	■	■	■
DNP3					■		■	
IEC 60870-5-103					■		■	
Physical Interface								
RS485	2-wire	■			■	■		■
	4-wire		■					
Fiber optic ST	Star			■			■	
	Ring						■ (2)	
See details on page		**60**	**61**	**62**	**63**		**63**	

(1) *Only one connection possible, S-LAN or E-LAN.*
(2) *Except with the Modbus protocol.*

Converter Selection Guide

	ACE9092	ACE919CA	ACE919CC	EGX100	EGX400
Converter					
Port to supervisor	1 RS232 port	1 2-wire RS485 port	1 2-wire RS485 port	1 Ethernet port 10T/100 Tx Auto	1 Ethernet port 10/100 base Tx and 1 Ethernet port 100 base Fx
Port to Sepam™	1 2-wire RS485 port	1 2-wire RS485 port	1 2-wire RS485 port	2-wire or 4-wire RS485 port	Two 2-wire RSRS485485 or 4-wire RS485 ports
Distributed power supply RS485	Supplied by ACE	Supplied by ACE	Supplied by ACE	Not supplied by EGX	Not supplied by EGX
Protocol					
Modbus	■	■	■	■	■
IEC 60870-5-103	■	■	■		
DNP3	■	■	■		
Power Supply					
DC			24 to 48 V DC	24 V DC	24 V DC
AC	110 to 220 V AC	110 to 220 V AC			100 to 240 V AC (with adapter)
See details on page	**69**	**70**	**70**	**See EGX100 Manual**	**See EGX400 Manual**

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Connection of Communication Accessories

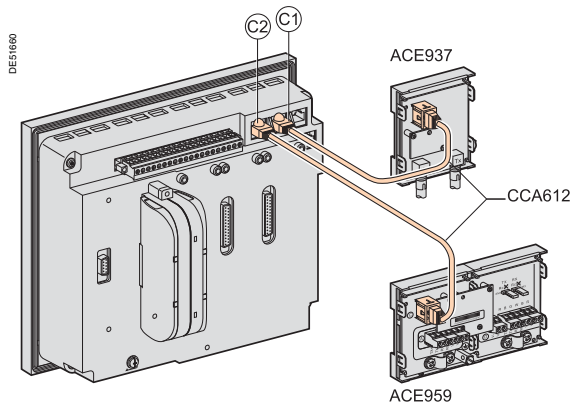
CCA612 Connection Cable

Connecting to Sepam™

The CCA612 connects a communication interface to a Sepam™ base unit:

- Length = 9.8 ft (3 m)
- Fitted with two green RJ45 plugs

Sepam™ Series 80



Sepam™ Series 80: Two communication ports

RS485 Network Cable

RS485 Network Cable	2-Wire	4-Wire
RS485 medium	1 shielded twisted pair	2 shielded twisted pairs
Distributed power supply	1 shielded twisted pair	1 shielded twisted pair
Shielding	Tinned copper braid, coverage > 65 %	
Characteristic impedance	120 Ω	
Gauge	AWG 24	
Resistance per unit length	< 100 Ω/km (62.1 Ωmi)	
Capacitance between conductors	< 60 pF/m (18.3 pF/ft)	
Capacitance between conductor and shielding	< 100 pF/m (30.5 pF/ft)	
Maximum length	1300 m (4270 ft)	

Fiber Optic				
Fiber type		Multimode glass		
Wavelength		820 nm (infra-red)		
Type of connector		ST (BFOC bayonet fiber optic connector)		
Fiber Optic Diameter (µm)	**Numerical Aperture (NA)**	**Maximum Attenuation (dBm/km)**	**Minimum Optical Power Available (dBm)**	**Maximum Length of Fiber (m)**
50/125	0.2	2.7	5.6	700 (2300 ft)
62.5/125	0.275	3.2	9.4	1800 (5900 ft)
100/140	0.3	4	14.9	2800 (9200 ft)
200 (HCS)	0.37	6	19.2	2600 (8500 ft)

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ACE9492
2-Wire RS485 Network Interface

PE50029

ACE9492 two-wire RS485 network connection interface

Function

The ACE9492 interface performs two functions:

- It provides an electrical interface between Sepam™ and a two-wire RS485 communication network
- It is the main network cable branching box that connects Sepam™ with a CCA612 cord

Characteristics

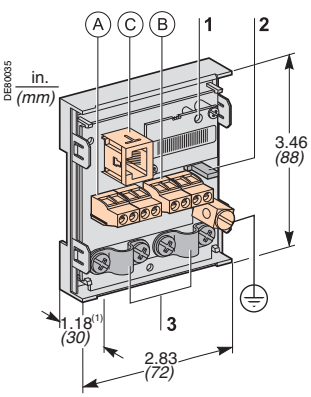
ACE9492 Module	
Weight	0.1 kg (0.22 lb.)
Assembly	On symmetrical DIN rail
Operating temperature	–25°C to +70°C (–13°F to +158°F)
Environmental characteristics	Same characteristics as Sepam™ base units

Two-Wire RS485 Electrical Interface	
Standard	EIA 2-wire RS485 differential
Distributed power supply	External, 12 V DC or 24 V DC ±10%
Power burden	16 mA in receiving mode
	40 mA maximum in sending mode

Maximum Length of Two-Wire RS485 Network with Standard Cable

Number of Sepam™ Units	Maximum Length with 12 V DC Power Supply	Maximum Length with 24 V DC Power Supply
5	1000 ft. (320 m)	3300 ft (1000 m)
10	590 ft (180 m)	2500 ft (750 m)
20	520 ft (160 m)	1500 ft (450 m)
25	410 ft (125 m)	1200 ft (375 m)

DE80035



(1) *2.8 in (70 mm) with CCA612 cord connected*

Description and Dimensions

(A) and (B) Terminal blocks for network cable

(C) RJ45 socket to connect the interface to the base unit with a CCA612 cord

(t) Grounding terminal

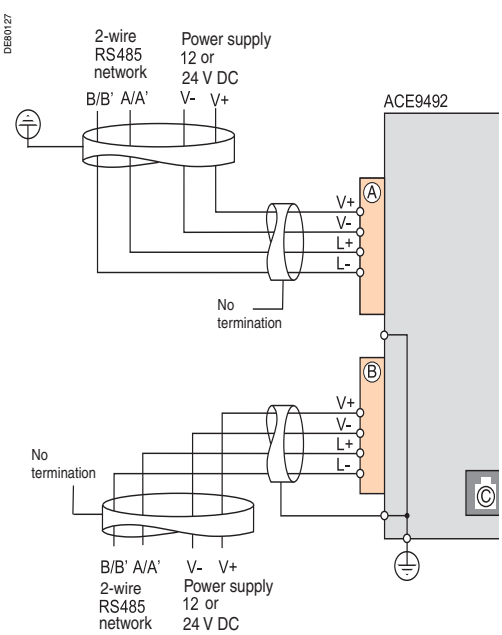
1 The Link Activity LED flashes when active communication occurs (sending or receiving is in progress).

2 The jumper for RS485 network line-end impedance matching with load resistor (Rc = 150 Ω), is set to:

- ~~Rc~~, if the module is not at one end of the network (default position). The "X" over the "Rc" indicates that the resistor is not in use.
- Rc, if the module is at one end of the network. This means the resistor is jumpered in.

3 Network cable clamps (inner diameter of clamp = 6 mm or 0.24 in).

DE80127



Connection

1 Connect the network cable to screw-type terminal blocks (A) and (B)

2 Connect the ground terminal by tinned copper braid with cross-section ≥ 6 mm² (AWG 10), or cable with cross-section ≥ 2.5 mm² (AWG 12), and length ≤ 200 mm (7.9 in), fitted with a 4 mm (0.16 in) ring lug.

3 Check the tightness. The maximum tightening torque is 19.5 in-lb (2.2 Nm).

4 The interfaces are fitted with clamps to hold the network cable and recover shielding at the incoming and outgoing points of the network cable:

- The network cable must be stripped
- The cable shielding braid must physically contact (and wrap around) the clamp

5 Use a CCA612 cord (length = 9.8 feet, or 3 m, with green fittings) to connect the interface to connector (C) on the base unit

6 Supply 12 V DC or 24 V DC to the interfaces

Note : *The cable shielding shown at left should only be done at one point, preferably at one end of the daisy chain.*

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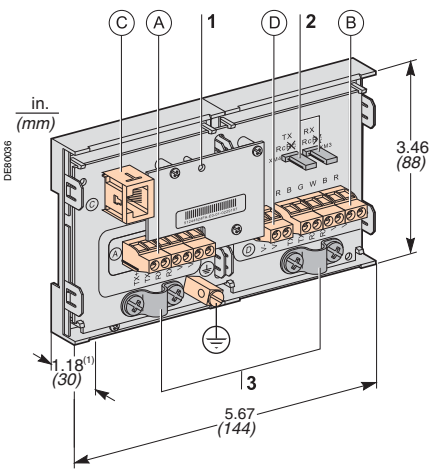
ACE959
4-Wire RS485 Network Interface

PE50023

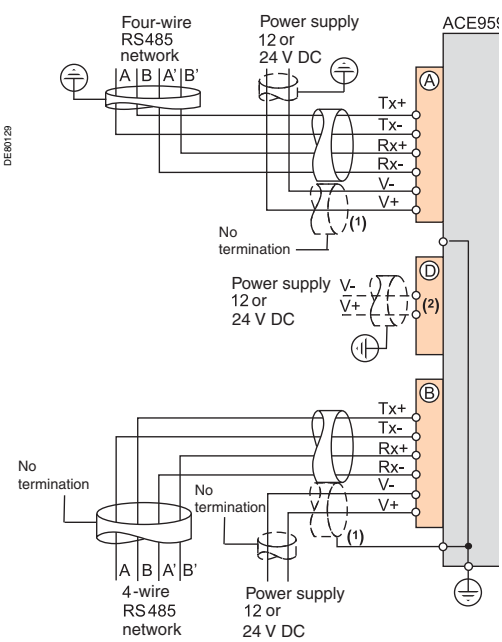
ACE959 Four-Wire RS485 Network Connection Interface.

DE80036



(1) *70 mm (2.8 in) with CCA612 cord connected.*

DE80129



(1) *Distributed power supply with separate wiring or included in the shielded cable (3 pairs)*

(2) *Terminal block for connection of the distributed power supply module*

Function

The ACE959 interface performs two functions:

- It provides an electrical interface between Sepam™ and a 4-wire RS485 communication network
- It is the main network cable branching box for connecting a Sepam™ with a CCA612 cord

Characteristics

ACE959 Module	
Weight	0.2 kg (0.441 lb)
Assembly	On symmetrical DIN rail
Operating temperature	–25°C to +70°C (–13°F to +158°F)
Environmental characteristics	Same characteristics as Sepam™ base units
Four-Wire RS485 Electrical Interface	
Standard	EIA 4-wire RS485 differential
Distributed power supply	External, 12 V DC or 24 V DC ±10%
Power burden	16 mA in receiving mode
	40 mA maximum in sending mode

Maximum Length of Four-Wire RS485 Network with Standard Cable

Number of Sepam™ Units	Maximum Length with 12 V DC Power Supply	Maximum Length with 24 V DC Power Supply
5	320 m (1000 ft)	1000 m (3300 ft)
10	180 m (590 ft)	750 m (2500 ft)
20	160 m (520 ft)	450 m (1500 ft)
25	125 m (410 ft)	375 m (1200 ft)

Description and Dimensions

(A) and (B) are terminal blocks for network cable connection

(C) RJ45 socket is used to connect the interface to the base unit with a CCA612 cord

(D) Terminal block is for a separate auxiliary power supply (12 V DC or 24 V DC)

(t) Grounding terminal

1 The link activity LED flashes when active communication occurs (sending or receiving in progress).

2 The jumper for 4-wire RS485 network line-end impedance matching with load resistor (Rc = 150 Ω), is set to:

- ~~Rc~~, if the module is not at one end of the network (default position). The "X" over the "Rc" indicates that the resistor is not in use.
- Rc, if the module is at one end of the network. This means the resistor is jumpered in.

3 Network cable clamps. The inner diameter of clamp is 6 mm or 0.24 in

Connection

1 Connect the network cable to screw-type terminal blocks (A) and (B) .

2 Connect the ground terminal with a copper braid having a cross-section ≥ 6 mm² (AWG 10), or cable with cross-section ≥ 2.5 mm² (AWG 12), and length ≤ 200 mm (7.9 in), fitted with a 4 mm (0.16 in) ring lug.

3 Check the tightness. The maximum tightening torque is 19.5 in-lb (2.2 Nm).

4 The interfaces have clamps that hold the network cable and recover shielding at the incoming and outgoing points of the network cable;

- The network cable must be stripped
- The cable shielding braid must wrap around and physically contact the clamp

5 Connect the interface to connector (C) on the base unit using a CCA612 cord (length = 3 m or 9.8 ft, green fittings).

6 Supply 12 V DC or 24 V DC to the interfaces.

7 The ACE959 can connect to a separate distributed power supply (not included in shielded cable). Terminal block (D) is used to connect the distributed power supply module.

Note : *The cable shielding shown at left should only be done at one point, preferably at one end of the daisy chain.*

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ACE937 Fiber Optic Interface

PE50024

ACE937 fiber optic connection interface.

Function

The ACE937 interface connects Sepam™ to a fiber optic communication star system. A CCA 612 cord connects this remote module to the Sepam™ base unit.

Characteristics

ACE937 Module	
Weight	0.1 kg (0.22 lb)
Assembly	On symmetrical DIN rail
Power supply	Supplied by Sepam™
Operating temperature	–25°C to +70°C (–13°F to +158°F)
Environmental characteristics	Same characteristics as Sepam™ base units

Fiber Optic Interface				
Fiber type		Graded-index multimode silica		
Wavelength		820 nm (invisible infra-red)		
Type of connector		ST (BFOC bayonet fiber optic connector)		
Fiber Optic Diameter (µm)	**Numerical Aperture (NA)**	**Maximum Attenuation (dBm/km)**	**Minimum Optical Power Available (dBm)**	**Maximum Fiber Length**
50/125	0.2	2.7	5.6	700 m (2300 ft)
62.5/125	0.275	3.2	9.4	1800 m (5900 ft)
100/140	0.3	4	14.9	2800 m (9200 ft)
200 (HCS)	0.37	6	19.2	2600 m (8500 ft)

The maximum length is calculated with:

- Minimum optical power available
- Maximum fiber attenuation
- Losses in two ST connectors: 0.6 dBm
- Optical power margin: 3 dBm (according to IEC 60870 standard)

Example for a 62.5/125 µm fiber
Lmax = (9.4 - 3 - 0.6)/3.2 = 1.8 km (1.12 mi)

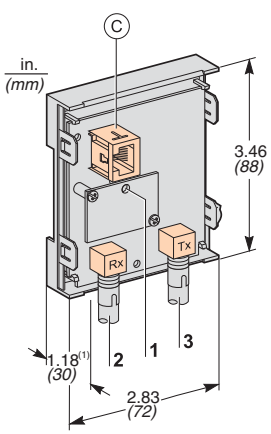
⚠ CAUTION

POTENTIAL EYE INJURY

- Never look directly into the end of a fiber optic cable

Failure to follow this instruction can cause serious injury.

DE80037



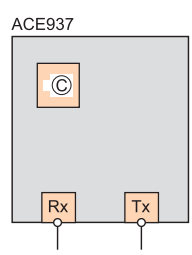
(1) *70 mm (2.8 in) with CCA612 cord connected.*

Description and Dimensions

(C) RJ45 socket connects the interface to the base unit with a CCA612 cord

1 The link activity LED flashes when active communication occurs (sending or receiving in progress)
2 Receive (Rx), female ST type connector (Sepam™ receiving)
3 Transmit (Tx), female ST type connector (Sepam™ sending)

DE51666



Connection

- The sending and receiving fiber optic fibers must be equipped with male ST type connectors
- Fiber optics screw-locked to Rx and Tx connectors

Use a CCA612 cable (length = 9.8 ft, or 3 m, green fittings) to connect the interface to (C) on the base unit.

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ACE969TP and ACE969FO Multi-Protocol Interfaces

PE50470

ACE969TP Communication Interface

PE50471

ACE969FO Communication Interface

Function

The ACE969 multi-protocol communication interfaces function with Sepam™ Series 20, 40, or 80. They have two communication ports to connect a Sepam™ to two independent communication networks:

- The S-LAN (Supervisory Local Area Network) port to connect Sepam™ to a supervision network using one of the three following protocols:
  - IEC 60870-5-103
  - DNP3
  - RTU Modbus

The communication protocol is selected when setting Sepam™ parameters

- The E-LAN (engineering local area network) port, reserved for Sepam™ remote parameter setting and operation using the SFT2841 software

There are two versions of the ACE969 interfaces. Each has different S-LAN ports:

- ACE969TP (Twisted Pair) is for connecting to an S-LAN network using a two-wire RS485 connection
- ACE969FO (Fiber Optic) is for connecting to an S-LAN network using a fiber-optic connection (star or ring)

The E-LAN port is always a two-wire RS485 connection.

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ACE969TP and ACE969FO Multi-Protocol Interfaces

Characteristics

ACE969 Module

Technical Characteristics

Weight	0.285 kg (0.628 lb)	
Assembly	On symmetrical DIN rail	
Operating temperature	–13°F to +158°F (–25°C to +70°C)	
Environmental characteristics	Same characteristics as Sepam™ base units	

Power Supply

Voltage	24 to 250 V DC	110 to 240 V AC
Range	–20%/+10%	–20%/+10%
Maximum burden	2 W	3 VA
Inrush current	< 10 A 100 µs	
Acceptable ripple content	12%	
Acceptable momentary outages	20 ms	

Two-Wire RS485 Communication Ports

Electrical Interface

Standard	EIA 2-wire RS485 differential	
Distributed power supply	External, 12 V DC or 24 V DC ±10%	
Power burden	16 mA in receiving mode	
	40 mA in sending mode	
Max. number of Sepam™ units	25	

Maximum Length of 2-Wire RS485 Network

Number of Sepam™ Units	With Distributed Power Supply	
	12 V DC	24 V DC
5	1000 ft (320 m)	3300 ft (1000 m)
10	590 ft (180 m)	2500 ft (750 m)
20	430 ft (130 m)	1500 ft (450 m)
25	410 ft (125 m)	1200 ft (375 m)

Fiber Optic Communication Port

Fiber Optic Interface

Fiber type	Graded-index multimode silica
Wavelength	820 nm (invisible infra-red)
Type of connector	ST (BFOC bayonet fiber optic connector)

Maximum Length of Fiber Optic Network

Fiber Diameter (µm)	Numerical Aperture (NA)	Attenuation (dBm/km)	Minimum Optical Power Available (dBm)	Maximum Fiber Length
50/125	0.2	2.7	5.6	2300 ft (700 m)
62.5/125	0.275	3.2	9.4	5900 ft (1800 m)
100/140	0.3	4	14.9	9200 ft (2800 m)
200 (HCS)	0.37	6	19.2	8500 ft (2600 m)

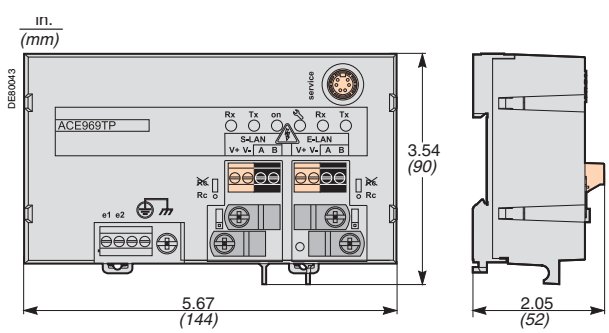
Maximum length is calculated with:

- Minimum optical power available
- Maximum fiber attenuation
- Losses in two ST connectors: 0.6 dBm
- Optical power margin: 3 dBm (according to IEC 60870 standard)

Example for a 62.5/125 µm fiber

Lmax = (9.4 - 3 - 0.6)/3.2 = 1.8 km (1.12 mi)

Dimensions



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ACE969TP and ACE969FO Multi-Protocol Interfaces
Description

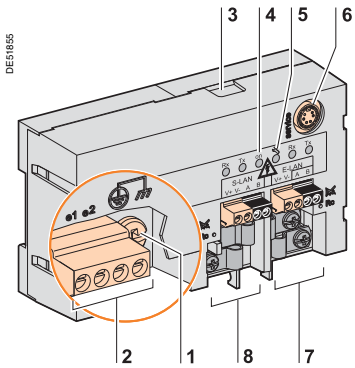
ACE969 Communication Interfaces

Component Description

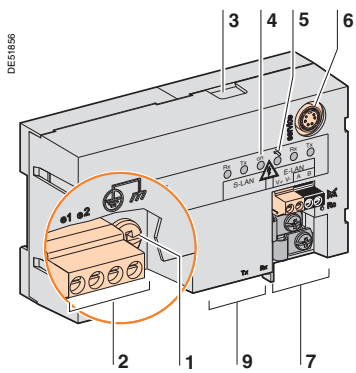
1 Grounding terminal using supplied braid
2 Power-supply terminal block
3 RJ45 socket to connect the interface to the base unit with a CCA612 cord
4 Green LED: ACE969 energized
5 Red LED: ACE969 interface status
- LED off = ACE969 set up and communication operational
- LED flashing = ACE969 not set up or setup incorrect
- LED remains on = ACE969 failed

6 Service connector: reserved for software upgrades
7 E-LAN 2-wire RS485 communication port (ACE969TP and ACE969FO)
8 S-LAN 2-wire RS485 communication port (ACE969TP)
9 S-LAN fiber-optic communication port (ACE969FO)

ACE969TP



ACE969FO



Two-Wire RS485 Communication Ports

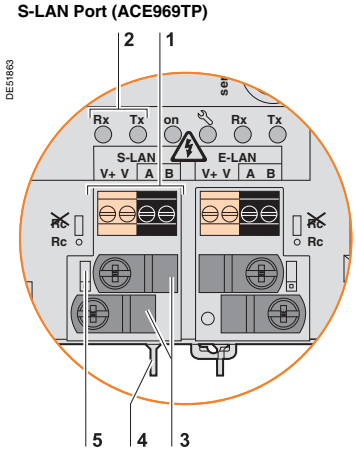
Component Description

1 Two-Wire RS485 Network Terminal Block:
- Two black terminals connect the two-wire RS485 twisted pair
- Two green terminals connect a twisted pair for distributed power supply

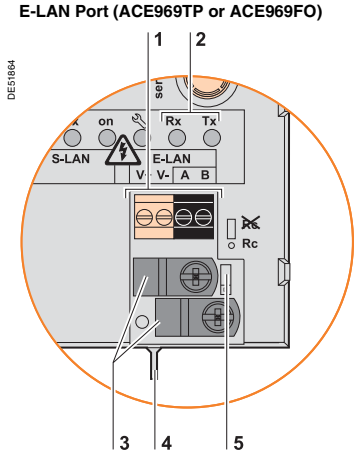
2 LEDs:
- Flashing Tx LED: Sepam™ sending
- Flashing Rx LED: Sepam™ receiving

3 Clamps and recovery of shielding for two network cables, incoming and outgoing (inner diameter of clamps = 6 mm or 0.24 in)
4 Fixing stud for network cable ties
5 The jumper for two-wire RS485 network line-end impedance matching with load resistor (Rc = 150 Ω), is set to:
- ~~Rc~~, if the module is not at one end of the network (default position). The "X" over the "Rc" indicates that the resistor is not in use.
- Rc, if the module is at one end of the network. This means the resistor is jumpered in.

S-LAN Port (ACE969TP)



E-LAN Port (ACE969TP or ACE969FO)



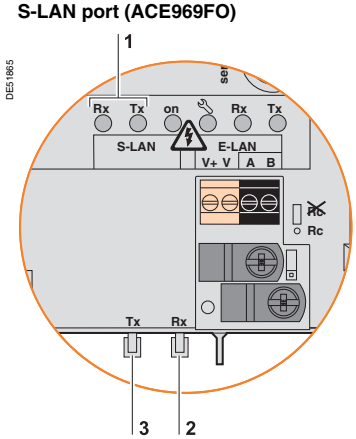
Fiber Optic Communication Port

Component Description

1 LEDs:
- Flashing Tx LED: Sepam™ sending
- Flashing Rx LED: Sepam™ receiving

2 Rx, female ST type connector (Sepam™ receiving)
3 Tx, female ST type connector (Sepam™ sending)

S-LAN port (ACE969FO)



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ACE969TP and ACE969FO Multi-Protocol Interfaces
Connection

Power Supply and Sepam™

- The ACE969 interface connects to ***C*** on the Sepam™ base unit (refer to page 13) using a CCA612 cord (length = 3 m or 9.8 ft, green RJ45 fittings)
- 24 to 250 V DC or 110 to 230 V AC operates the ACE969 interface.

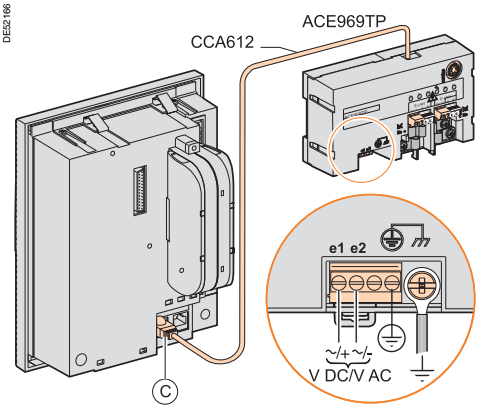
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

DE52166



Terminals	Type	Wiring
e1-e2 - supply	Screw terminals	■ Wiring with no fittings: □ One wire with maximum cross-section 0.2 to 2.5 mm²(≥ AWG 24-12) or two wires with maximum cross-section 0.2 to 1 mm²(≥ AWG 24-18) □ Stripped length: 8 to 10 mm (0.31 to 0.39 in) ■ Wiring with fittings: □ recommended wiring with Telemecanique fitting: - DZ5CE015D for 1 wire 1.5 mm² (AWG 16) - DZ5CE025D for 1 wire 2.5 mm² (AWG 12) - AZ5DE010D for 2 wires 1 mm² (AWG 18) □ Tube length: 0.32 in (8.2 mm) □ Stripped length: 0.31 in (8 mm).
DE51962 ⏚ Protective ground	Screw terminal	1 green/yellow wire, max. length 9.8 ft (3 m) and max. cross-section 2.5 mm² (AWG 12)
DE51845 Functional ground	0.16 in (4 mm) ring lug	Grounding braid, supplied for connection to cubicle grounding

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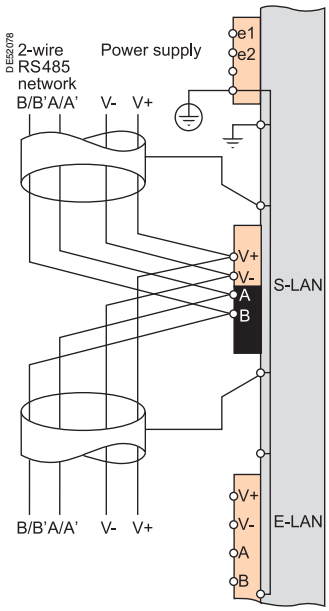
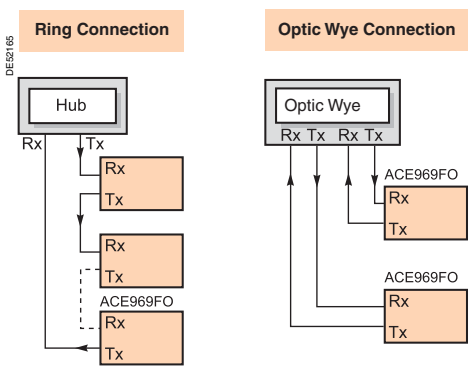
ACE969TP and ACE969FO Multi-Protocol Interfaces
Connection



Two-Wire RS485 Communication Ports (S-LAN or E-LAN)

1 Connect the RS485 twisted pair (S-LAN or E-LAN) to black terminals A and B.
2 Connect the twisted pair for the distributed power supply to green terminals V+ and V-.
3 The interfaces are fitted with clamps to hold the network cable in place and to recover shielding at the incoming and outgoing points of the network cable:
   - The network cable must be stripped
   - The cable shielding must be around and in contact with the clamp
   - Shielding continuity of incoming and outgoing cables is ensured by the electrical continuity of the clamps
4 An internal connection links all cable clamps to the ACE969 Interface grounding terminals (protective and functional grounding), with the shielding of the RS485 cables is grounded as well.
5 On the ACE969TP interface, the cable clamps for the S-LAN and E-LAN RS485 networks are grounded.

Note : *The cable shielding shown at left should only be done at one point, preferably at one end of the daisy chain.*



Fiber Optic Communication Port (S-LAN)

⚠ CAUTION

HAZARD OF BLINDING
Never look directly into the fiber optic.

Failure to follow this instruction can cause serious injury.

The fiber optic connection can be made:
- point-to-point to an optic star system
- in a ring system (active echo)

The transmitting and receiving fiber optic fibers must have male ST type connectors. The fiber optics screw-lock to ***Rx*** and ***Tx*** connectors.

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ACE9092
RS232/RS485 Converter

PE50035

ACE909-2 RS 232/RS485 Converter.

Function

The ACE9092 converter connects a master/central computer equipped with a V24/RS232 type serial port (as a standard feature) to stations connected to a two-wire RS485 network.

After you set the operating parameters, the ACE9092 converter uses two-way simplex (half-duplex, single-pair) transmission to provide conversion, network polarization, and automatic frame dispatching between the master and the stations without the need for any flow control signals.

The ACE9092 converter also provides a 12 V DC or 24 V DC supply voltage for the distributed power supply of the Sepam™ ACE9492, ACE959 or ACE969 interfaces.

The communication settings should be the same as the Sepam™ and supervisor communication settings.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

Characteristics

Mechanical Characteristics		
Weight	0.280 kg (0.617 lb)	
Assembly	On symmetrical or asymmetrical DIN rail	
Electrical Characteristics		
Power supply	110 to 220 V AC ± 10%, 47 to 63 Hz	
Galvanic isolation between ACE power supply and frame, and between ACE power supply and interface supply	2000 Vrms, 50 Hz, 1 min	
Galvanic isolation between RS 232 and RS485 interfaces	1000 Vrms, 50 Hz, 1 min	
Protection by time-delayed fuse 5 mm x 20 mm (0.2 in x 0.79 in)	1 A rating	
Communication and Sepam™ Interface Distributed Supply		
Data format	11 bits: 1 start, 8 data, 1 parity, 1 stop	
Transmission delay	< 100 ns	
Distributed power supply for Sepam™ interfaces	12 V DC or 24 V DC	
Maximum number of Sepam™ interfaces with distributed supply	12	
Environmental Characteristics		
Operating temperature	–5°C to +55°C (+23°F to +131°F)	
Electromagnetic Compatibility	**Standard**	**Value**
Fast transient bursts, 5 ns	IEC 60255-22-4	4 kV with capacitive coupling in common mode 2 kV with direct coupling in common mode 1 kV with direct coupling in differential mode
1 MHz damped oscillating wave	IEC 60255-22-1	1 kV common mode 0.5 kV differential mode
1.2/50 µs impulse waves	IEC 60255-5	3 kV common mode 1 kV differential mode

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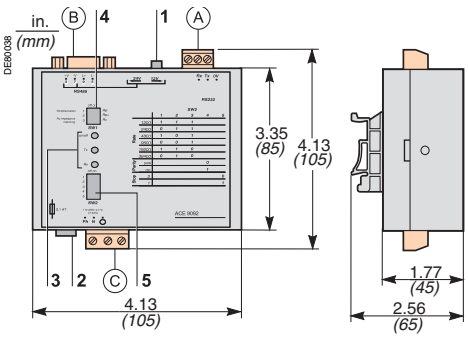
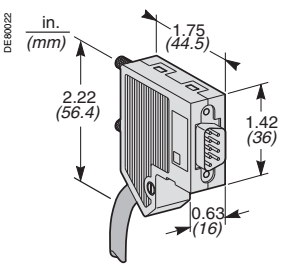
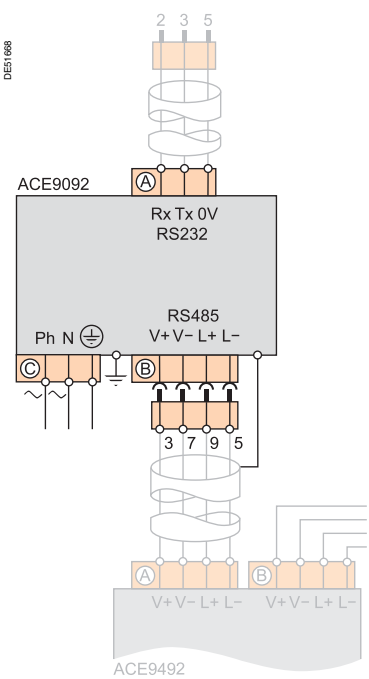
ACE9092
RS232/RS485 Converter





Male 9-pin sub-D connector supplied with the ACE9092



Description and Dimensions

(A) The terminal block for RS232 link is limited to 10 m (33 ft)

(B) The Female 9-pin sub-D connector attaches the two-wire RS485 network to the power supply

One screw-type male nine-pin sub-D connector is supplied with the converter.

(C) Power-supply terminal block

1 Distributed power supply voltage selector switch, 12 V DC or 24 V DC
2 Protection fuse, unlocked by a 1/4 turn
3 LEDs:
- ON/OFF: If ACE9092 is energized, this is ON
- Tx: ON if the RS232 sending by ACE9092 is active
- Rx: ON if the RS232 receiving by ACE9092 is active

4 SW1, parameter setting for two-wire RS485 network polarization and line impedance matching resistors

Function	SW1/1	SW1/2	SW1/3
Polarization at 0 V via Rp –470 Ω	ON		
Polarization at 5 V via Rp +470 Ω		ON	
Two-wire RS 485 network impedance matching by 150 Ω resistor			ON

5 SW2, parameter setting for asynchronous data transmission rate and format (this is the same parameters as for RS 232 link and 2-wire RS485 network)

(Baud) Rate	SW2/1	SW2/2	SW2/3	
1200	1	1	1	
2400	0	1	1	
4800	1	0	1	
9600	0	0	1	
19200	1	1	0	
38400	0	1	0	

Format	SW2/4	SW2/5
With parity check	0	
Without parity check	1	
1 stop bit (compulsory for Sepam™)		0
2 stop bits		1

Converter Configuration when Delivered
- 12 V DC distributed power supply
- 11-bit format, with parity check
- Two-wire RS485 network polarization and impedance matching resistors activated

Connection

RS232 Link
- To 2.5 mm² (AWG 12) screw type terminal block (A)
- Maximum length 10 m (33 ft)
- Rx/Tx: RS232 receiving/sending by ACE9092
- 0V: Rx/Tx common, **DO NOT GROUND**

Two-Wire RS485 Link with Distributed Power Supply
- To connector (B) female nine-pin sub-D
- Two-wire RS485 signals: L+, L–
- Distributed power supply: V+ = 12 V DC or 24 V DC, V- = 0 V

Power Supply
- To 2.5 mm² (AWG 12) screw type terminal block (C)
- Reversible phase and neutral
- Groundeded via terminal block and metal case (ring lug on back of case)

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ACE919CA and ACE919CC RS485/RS485 Converters

PE50036

ACE919CC RS485/RS485 converter.

Function

The ACE919 converters connect a master/central computer equipped with an RS485 type serial port to stations that are connected to a two-wire RS485 network.

The ACE919 converters perform network polarization and impedance matching without requiring any flow control signals.

The ACE919 converters also provide a 12 V DC or 24 V DC supply for the distributed power supply of the Sepam™ ACE9492, ACE959, or ACE969 interfaces.

There are two types of ACE919 converter:
- ACE919CC, DC-powered
- ACE919CA, AC-powered

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work is performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

Characteristics

Mechanical Characteristics		
Weight	0.280 kg (0.617 lb)	
Assembly	On symmetrical or asymmetrical DIN rail	
Electrical Characteristics	**ACE919CA**	**ACE919CC**
Power supply	110 to 220 V AC ±10%, 47 to 63 Hz	24 to 48 V DC ±20%
Protection by time-delayed fuse 5 mm x 20 mm (0.2 in x 0.79 in)	1 A rating	1 A rating
Galvanic isolation between ACE power supply and frame, and between ACE power supply and interface supply		2000 Vrms, 50 Hz, 1 min
Communication and Sepam™ Interface Distributed Supply		
Data format	11 bits: 1 start, 8 data, 1 parity, 1 stop	
Transmission delay	< 100 ns	
Distributed power supply for Sepam™ interfaces	12 V DC or 24 V DC	
Maximum number of Sepam™ interfaces with distributed supply	12	
Environmental Characteristics		
Operating temperature	–5°C to +55°C (+23°F to +131°F)	
Electromagnetic Compatibility	**Standard**	**Value**
Fast transient bursts, 5 ns	IEC 60255-22-4	4 kV with capacitive coupling in common mode 2 kV with direct coupling in common mode 1 kV with direct coupling in differential mode
1 MHz damped oscillating wave	IEC 60255-22-1	1 kV common mode 0.5 kV differential mode
1.2/50 µs impulse waves	IEC 60255-5	3 kV common mode 1 kV differential mode

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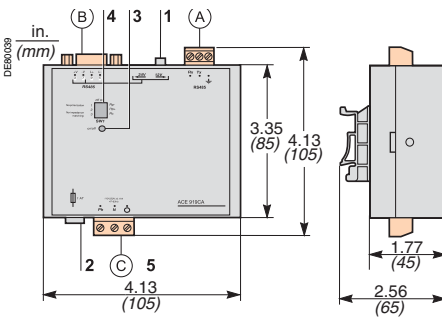
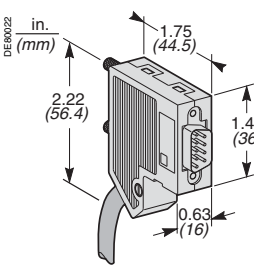
ACE919CA and ACE919CC RS485/RS485 Converters





Male 9-pin sub-D connector supplied with the ACE919

Description and Dimensions

(A) Terminal block for two-wire RS485 link without distributed power supply

(B) Female nine-pin sub-D connector, used to connect to the two-wire RS485 network with distributed power supply

One screw-type male nine-pin sub-D connector is supplied with the converter.

(C) Power supply terminal block

1 Distributed power supply voltage selector switch, 12 V DC or 24 V DC
2 Protection fuse, unlocked by a 1/4 turn
3 ON/OFF LED: this LED is ON if the ACE919 is energized
4 SW1, parameter setting of two-wire RS485 network polarization and line impedance matching resistors

Function	SW1/1	SW1/2	SW1/3
Polarization at 0 V via Rp -470 Ω	ON		
Polarization at 5 V via Rp +470 Ω		ON	
Two-wire RS485 network impedance matching by 150 Ω resistor			ON

Converter Configuration when Delivered

- 12 V DC distributed power supply
- Two-wire RS485 network polarization and impedance matching resistors activated

Connection

Two-Wire RS485 Link without Distributed Power Supply

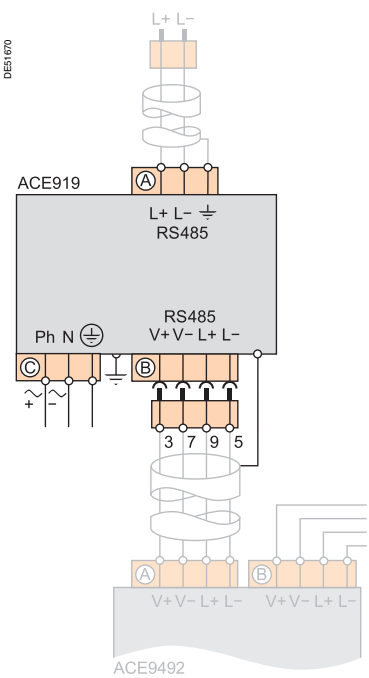
- To 2.5 mm² (AWG 12) screw type terminal block (A)
- L+, L-: two-wire RS485 signals
- ⏚ Shielding

Two-Wire RS485 Link with Distributed Power Supply

- To connector (B) female 9-pin sub-D
- Two-wire RS485 signals: L+, L–
- Distributed power supply: V+ = 12 V DC or 24 V DC, V- = 0 V

Power Supply

- To 2.5 mm² (AWG 12) screw type terminal block (C)
- Reversible phase and neutral (ACE919CA)
- Grounded via terminal block and metal case (ring lug on back of case)



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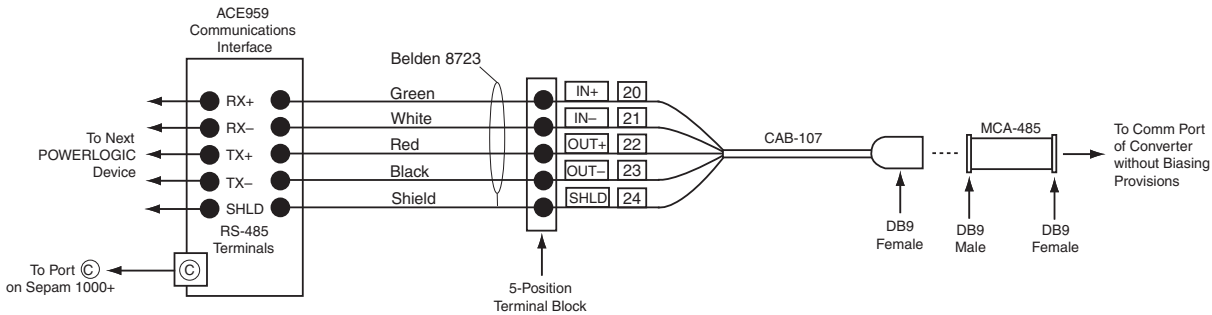
Communications Wiring
Biasing the Communications Link

To ensure reliable communications, you must bias the POWERLOGIC communications link (if biasing is not in the system master nor an interfacing RS232/485 converter). Use a Multipoint Communications Adapter (MCA-485) biasing device. Place the adapter between the first device on the link and the communications port of the PC. The illustration below shows installation of the adapter when the first device on the link is a Sepam™ Series 80 relay.

One set of biasing resistors is required per daisy chain. On the Black Box converter IC109A-R2, these can be activated by a switch. Other converters should be checked for configurable biasing. Biasing is recommended at or near the system master.



Connecting a Sepam Series 80 as the first device on a POWERLOGIC daisy chain using CAB107 cable, MCA-485, and terminal block

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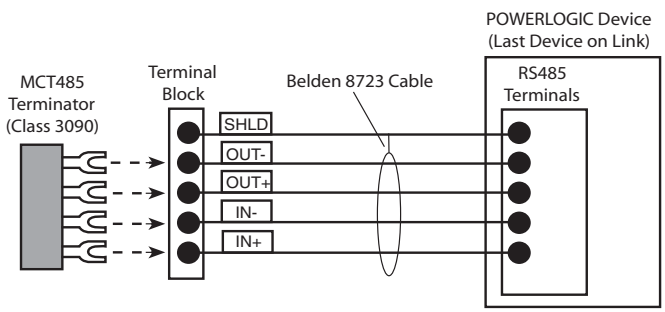
Communications Wiring
Terminating the Communications Link

To ensure reliable communications, terminate the last device on a POWERLOGIC communications link. The illustration below shows MCT-485 terminator placement when the final device on the link is a POWERLOGIC device. If the last device is a Sepam™ Series 80, see page 60 and page 62 for termination instructions.

If a communications link contains only a single device, it must be terminated. If a link contains multiple devices, as in the illustration on page 74, only the last device must be terminated.

One pair of terminating resistors is required at each end of an RS485 4-wire daisy chain. This can be accomplished by setting the movable jumpers on the ACE959 communications interface, the switches on Black Box converter IC109A-R2, or, for series 2000 circuit monitors, using a Multipoint Communication Adapter MCT-485. For series 4000 circuit monitors and series 600 power meters with screw-type terminals, use an MCTAS-485 (or an MCT-485 with a terminal block). Refer to the instruction bulletin for the specific device for more details.



Terminating a device using an MCT-485 and a terminal block

Integral jumpers on the Sepam™ ACE modules provide the ability to select terminating resistance (Rc) or not ('Rc). See the respective ACE module in this manual for details.

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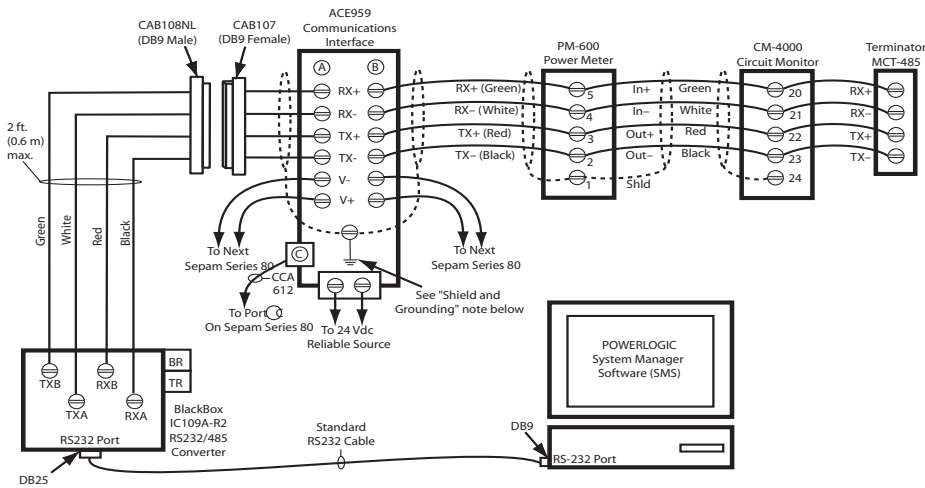
Communications Wiring
Communications Interface Wiring

For information on Communications Wiring starting at Port C on the base unit, see page 47. In North America, 4-wire communications wiring is recommended using the ACE959 communications interface.

This interface requires external 12/24 Vdc control power. See “Connecting to Sepam™” on page 59 for information on wiring the ACE959.

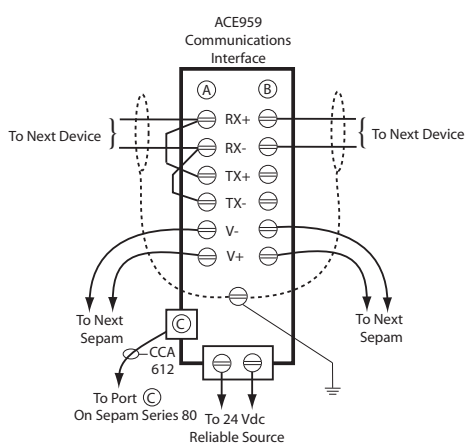
The illustrations on the following pages show typical communications network connections.



Notes:
Shield and Grounding— The shield is broken between two grounded shield termination points. Leave the shield intact from source until just before next shield ground. See Figure on page 79 for more information.

BR=Biasing Resistor. Also known as Polarizing Resistor (RP).
TR= Terminating Resistor (also known as

Typical Serial Communications Application (4-Wire)



Using 4-Wire Module in 2-Wire Daisy Chain

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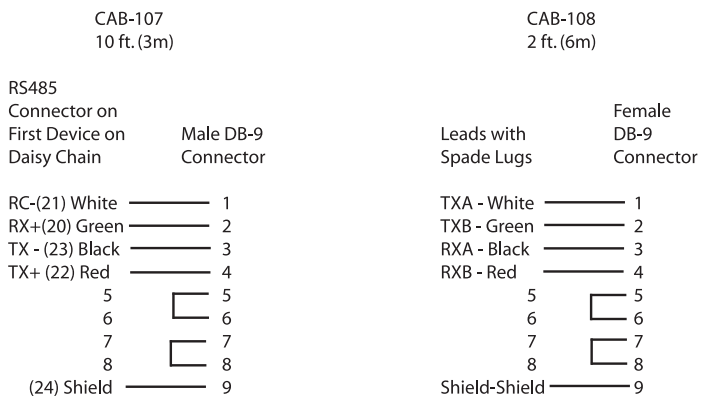
Communications Wiring
Cable Pinouts

Cable pinouts for CAB-107 and CAB-108 cables are shown below.



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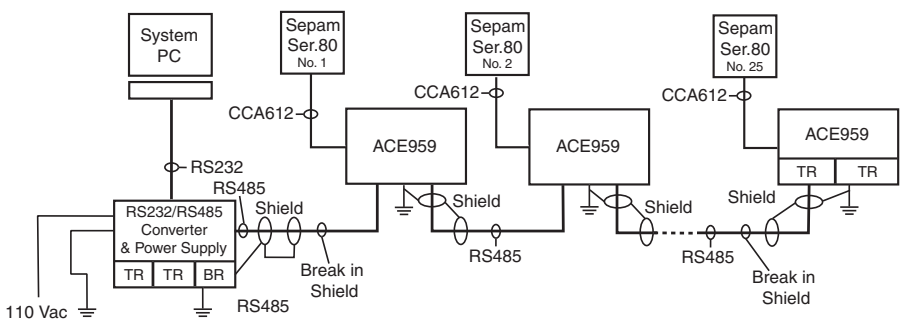

Notes:

- RS485 cable is 4-wire plus shield. 2-wire power (24 Vdc) is also required. Recommended cable:
  - ❏ Belden 9841 (1 pair)
  - ❏ Belden 9842 or 8723 (2 pair)
  - ❏ Fileca F3644-1 (2 pair signal/1 pair power)
- Shield is broken between two grounded shield termination points (typical). Leave the shield intact from source until just before next shield ground.
- Up to 25 Sepam Series 80 relays (maximum) on daisy chain.
- TR=Terminating Resistor
- Two TRs are required at each end of an RS485 4-wire diasy chain (can be accomplished by setting the movable jumpers on Sepam module ACE959, the switches on Black Box converter IC109A-R2, or, for series 2000 circuit monitors, using a Multipoint Communications Adapter MCT-485). For series 4000 circuit monitors and series 600 power meters with a screw-type terminal block, use an MCTAS-485 (or an MCT-485 with a terminal block). Refer to the device instruction bulletin for more details.
- BR= Biasing Resistor
- One BR set required per daisy chain (accomplish by setting switch on Black Box converter IC109A-R2; other converters should be checked for configurable biasing [recommended at or near system master]).
- One recommended RS232/RS485 Converter is Black Box IC109A-R2 (power supply separate).
- Shields should be grounded at one end only.

Network Daisy Chain Practices (including Shield Grounding)

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Communications Wiring
Network Limits

Network Limits for POWERLOGIC Devices and Sepam™ Series 80 Relays.

Network Limits for POWERLOGIC Devices

	Maximum Distance feet (meters) 4-Wire RS485 Daisy Chain	
Baud Rate	**1-16 Devices**	**17-32 Devices**
1200	10,000 (3,048)	10,000 (3,048)
2400	10,000 (3,048)	5,000 (1,524)
4800	10,000 (3,048)	5,000 (1,524)
9600	10,000 (3,048)	4,000 (1,219)①
19200	10,000 (3,048)	2,500 (762)
38400	5,000 (1,524)	2,000 (610)

①Lowering network baud rate to 9600 allows 7 POWERLOGIC devices and 25 Sepam™ Series 80s at 3,690 ft. (1,125 m).

Network Limits for Sepam™ Series 80 Relays (at max. 38,000 baud rate)

		Maximum Distance feet (meters) of 4-Wire RS485 Daisy Chain① Number of Sepam™ Series 80 Units Connected			
Cable	**Distributed Power**	**5**	**10**	**20**	**25**
Standard✍ AWG 24, 2-pair with resistance of 78.5 ohms/km	12 V	1,050 (320)	590 (180)	525 (160)	410 (125)
	24 V	3,281 (1,000)	2,460 (750)	1,476 (450)	1,230 (375)
Fileca F3644-1 specific cable	12 V	3,150 (960)	1,772 (540)	1,575 (480)	1,230 (375)
	24 V	4,265 (1,219)	4,265 (1,300)	4,265 (1,300)	3,690 (1,125)③

①With distributed power supply from one accessory.
✍Belden 9841 (1 pair shielded); Belden 9842 or 8723 (2 pair shielded).
③Lowering network baud rate to 9600 allows 7 POWERLOGIC devices and 25 Sepam™ Series 80s at 3,690 ft. (1,125 m).

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User-Machine Interfaces (UMI)
Presentation

Introduction

There are two types of User-Machine Interfaces (UMI) available for Sepam™ Series 80 base units:

- mimic-based UMI
- advanced UMI

The advanced UMI is integrated in the base unit or installed remotely on the cubicle. These integrated and remote advanced UMIs provide the same functions.

A Sepam™ Series 80 with a remote advanced UMI contains the following:

- a base unit without UMI, for mounting inside the LV compartment
- a remote advanced UMI (DSM303)
  - for flush mounting on the front panel of the cubicle in the location most suitable for the facility manager
  - for connection to the Sepam™ base unit using a prefabricated CCA77x cord

See page 52 for the characteristics of the remote advanced UMI module (DSM303).

PE50472

Sepam™ Series 80 Base Unit with integrated advanced UMI

Comprehensive Data for Facility Managers

The data required for local equipment operation is displayed on demand, such as:

- displaying all measurement and diagnosis data in numerical format with units and/or in bar graphs
- displaying operating and alarm messages with alarm acknowledgment and Sepam™ resetting
- displaying a list of activated protection functions and the main settings of major protection functions
- adapting activated protection function set points or time delays in response to new operating constraints
- displaying Sepam™ and remote module versions
- output testing and logic input status display
- displaying Logipam data: status of variables, timers
- two-word password protection for parameter and protection settings

PE50464

Sepam™ Series 80 Base Unit with Mimic-Based UMI

Local Control of Devices Using the Mimic-Based UMI

The mimic-based UMI provides local control of devices and has the same functions as the advanced UMI:

- Selecting the Sepam™ control mode
- Viewing device status on the animated mimic diagram
- Opening and closing all local devices that Sepam™ controls

Ergonomic Data Presentation

- Keypad keys identified by pictograms for intuitive navigation
- Menu-guided access to data
- Graphic LCD screen to display any character or symbol
- Excellent display quality under all lighting conditions
- Automatic contrast setting and backlit screen (user activated)

PE50474

Customized Chinese Advanced UMI

Working Language

All texts and messages displayed on the advanced UMI or the mimic-based UMI are available in two languages:

- US English, the default working language
- UK English as a second language

Please contact a representative about local language customization.

Connecting Sepam™ to the Parameter Setting Tool

Sepam™ uses SFT2841 software for protection and parameter settng. A PC with SFT2841 software connects to the RS232 communication port on the front of the unit.

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User-Machine Interfaces
Selection Guide

Base Unit	With Remote Advanced UMI	With Integrated Advanced UMI	With Mimic-Based UMI
	PE50260	PE50262	PE50464
Functions			
Local Indication			
Metering and diagnosis data	■	■	■
Alarms and operating messages	■	■	■
List of activated protection functions	■	■	■
Main protection settings	■	■	■
Version of Sepam™ and remote modules	■	■	■
Status of logic inputs	■	■	■
Logipam data	■	■	■
Switchgear status on the animated mimic diagram			■
Phasor diagram of currents or voltages			■
Local Control			
Alarm acknowledgement	■	■	■
Sepam™ reset	■	■	■
Output testing	■	■	■
Selection of Sepam™ control mode			■
Device open/close command			■
Characteristics			
Screen			
Size	128 x 64 pixels	128 x 64 pixels	128 x 240 pixels
Automatic contrast setting	■	■	■
Backlit screen	■	■	■
Keypad			
Number of keys	9	9	14
Control-mode keyed selector switch			Remote / Local / Test
LEDs			
Sepam™ operating status	■ base unit: 2 LEDs visible on back ■ remote advanced UMI: 2 LEDs visible on front	2 LEDs, visible from front and back	2 LEDs, visible from front and back
Indication LEDs	9 LEDs on remote advanced UMI	9 LEDs on front	9 LEDs on front
Mounting			
	■ bare base unit, mounted at the back of the compartment using the AMT880 mounting plate ■ DSM303 remote advanced UMI module, flush mounted in front of the cubicle and connected to the base unit with a CCA77x prefabricated cord (DSM303 and cable ordered separately)	Flush mounted on front of cubicle	Flush mounted on front of cubicle

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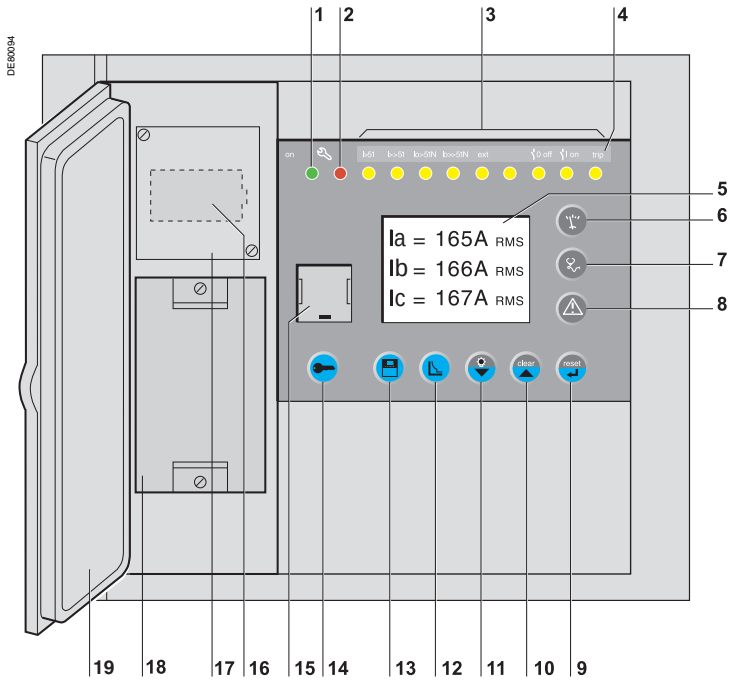
Identification	Icon	Description
1		Green LED: Sepam™ **ON**
2		Red LED: Sepam™ **UNAVAILABLE**
3		Nine yellow indication LEDs (L1 to L9 from left to right)
4		Label identifying the indication LEDs
5		Graphical LCD screen
6		Measurement display
7		Switchgear, network and machine diagnosis data display
8		Alarm history display
9		Two-function key, depending on the screen displayed "Confirm" function for the entered values and selecting an item or expression
10	clear	Two-function key, depending on the screen displayed "Clear" function used to: ■ acknowledge the active alarm ■ reset peak demand measurements and diagnosis information ■ clear the alarm history
		"Cursor up" function
11		Two-function key ■ key pressed for five seconds: LED and display test. Momentarily depressed to turn on backlight.
		■ key pressed briefly: Cursor down
12		Sepam™ and Logipam data display
13		Display and adaptation of the settings of active protection functions
14		Access to screen for password entry
15		PC connection port
16		Backup battery
17		Protective battery cover
18		Memory cartridge
19		Door

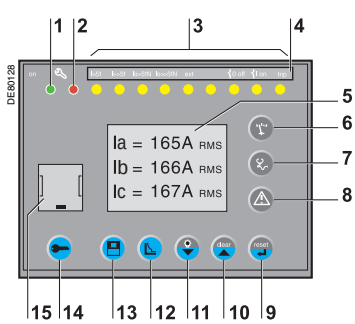
Integrated Advanced UMI



⚠ CAUTION

DAMAGE TO CARTRIDGE
Do not install or remove the memory cartridge with the power on.
Failure to follow this instruction can cause equipment damage.

DSM303 Remote Advanced UMI Module



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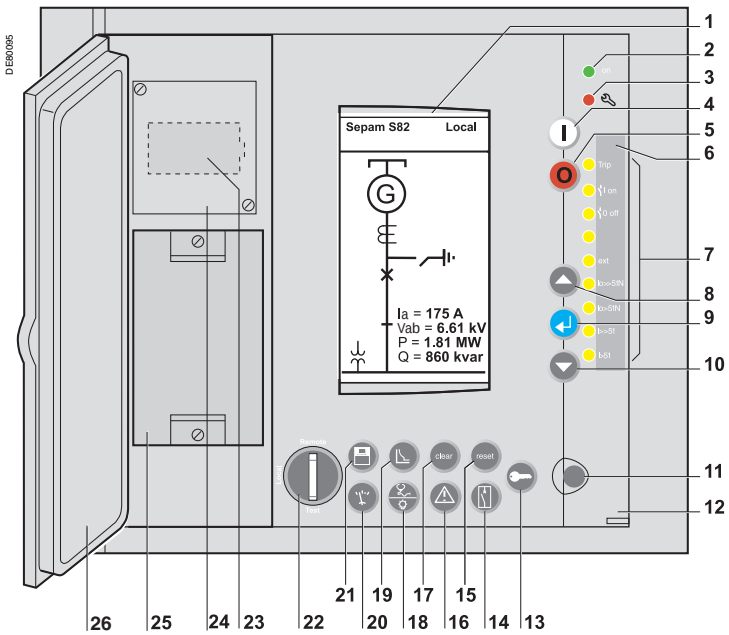
Description of the Mimic-Based UMI

Identification	Picto	Description
1		Graphical LCD screen
2		Green LED: Sepam™ **ON**
3		Red LED: Sepam™ **UNAVAILABLE**
4		Local closing of devices selected on the mimic-based UMI
5		Local opening of devices selected on the mimic-based UMI
6		Label identifying the indication LEDs
7		Nine yellow indication LEDs (L1 to L9 from bottom to top)
8		Move cursor up
9		"Confirm" data entry
10		Move cursor down
11		PC connection port
12		Transparent door
13		Access to screen for "password entry"
14		Display the "Mimic-diagram"
15	reset	"Reset" the latched information
16		Display the "Alarm history"
17	clear	Key used to: ■ "Acknowledge" the active alarm ■ "Reset: peak demand measurements and diagnosis information ■ "Clear" alarm history
18		Two-function key: ■ key pressed briefly: display of switchgear, network and machine diagnosis data ■ key pressed for five seconds: LED and display test
19		Display and adaptation of the settings of active protection functions
20		Display of measurements and phasor diagram
21		Display of Sepam™ and Logipam data
22		Three-position key switch to select Sepam™ control mode: "Remote," "Local," or "Test"
23		Backup battery
24		Protective battery cover
25		Memory cartridge
26		Door



⚠ CAUTION

DAMAGE TO CARTRIDGE
Do not install or remove the memory cartridge with the power on.
Failure to follow this instruction can cause equipment damage.

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Local Operation on the UMI
Types of Operations and Passwords

Types of Operations

The Sepam™ UMI can perform three types of operations:
- normal operations, such as consulting operating information, resetting Sepam™ and current alarms acknowledgement
- protection settings, like modifying the tripping set point of an active protection function
- modifying Sepam™ parameters: for example, change the operating language or set the internal clock

Protection setting and parameter operations require a password.

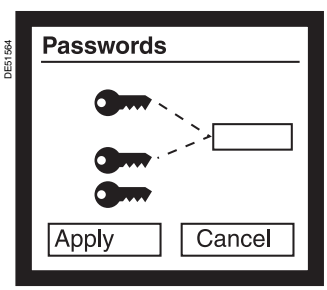
Passwords

Protection setting and parameter operations are protected by two different passwords, each having four digits:
- password for protection settings
- password for parameter settings

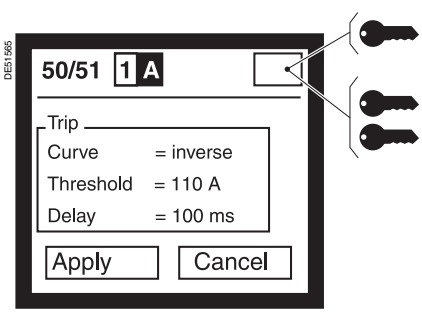
The default passwords are 0000.

The table below indicates the operations authorized for each password.

Operations	No Password	Protection-Setting Password	Parameter-Setting Password
Normal operation	■	■	■
Set the active protection functions (1)		■	■
Modify Sepam™ parameters			■



Screen for password entry.



Indication of password validity on the display:
= password for protection settings is valid.

= password for parameter settings is valid.

Entering Passwords

Perform the following steps to enter a password:

1 Press to access the screen for password entry.
2 Press to position the cursor on the first digit.
3 Press the cursor keys and as needed to scroll through the digits.
4 Press to confirm and go to the next digit.
(Do not use characters other than numbers 0 to 9 for each of the 4 digits.)
5 After the four digits are entered, press to position the cursor on [Apply].
6 Press again to confirm.

Validating Passwords

Password Validity

After entering the protection-setting password, the icon displays at the top of the screen.

After entering the parameter-setting password, the icon displays at the top of the screen.

The icon remains displayed as long as the password is valid, and the corresponding operations are authorized.

End of Validity

A password is deactivated either by pressing or automatically if no keys are activated for more than 5 minutes.

Loss of Passwords

Contact a technical support representative for information.

(1) *SFT2841 software required*

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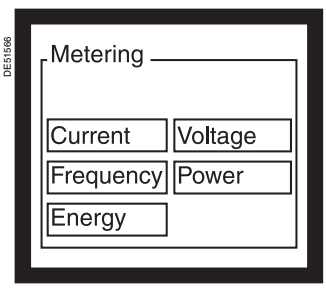
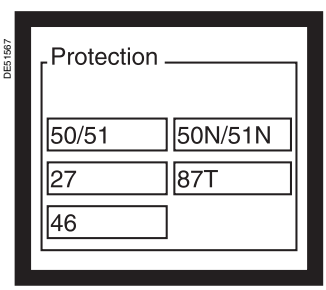


Selection screen for measurements



Selection screen for active protection functions

Categories of Operating Information

Sepam™ operating information is grouped in five categories:

- measurements, accessed by
- diagnosis data, accessed by
- alarm history, accessed by
- Sepam™ and Logipam data, accessed by
- active protection functions settings, accessed by

These five categories are divided into subcategories used to access data, as shown below.

Key	Information Category	Sub-Category
	Measurements	■ Current ■ Voltage ■ Frequency ■ Power ■ Energy ■ Phasor (on mimic-based UMI only)
	Switchgear, network and machine diagnosis	■ Diagnostic ■ Tripping context 0 (last recorded tripping context) ■ Tripping context -1 (next to last recorded tripping context) ■ Tripping context -2 ■ Tripping context -3 ■ Tripping context -4 ■ Out-of-sync context
	Alarm history (16 last recorded alarms)	■ List of alarms in sets of four ■ Detailed information on individual alarms
	Sepam™ and Logipam data	■ General information □ Base Unit Identification □ General Parameters □ Sepam™ Internal Clock ■ Remote Modules: □ Module Identification ■ Inputs/Outputs: □ status and test of logic outputs □ status of logic inputs ■ Logipam (if Logipam option is available): □ Logipam program Identification □ Configuration Bits □ Counters
	Settings of active protection functions	Access to each individual protection function, by selecting its ANSI code

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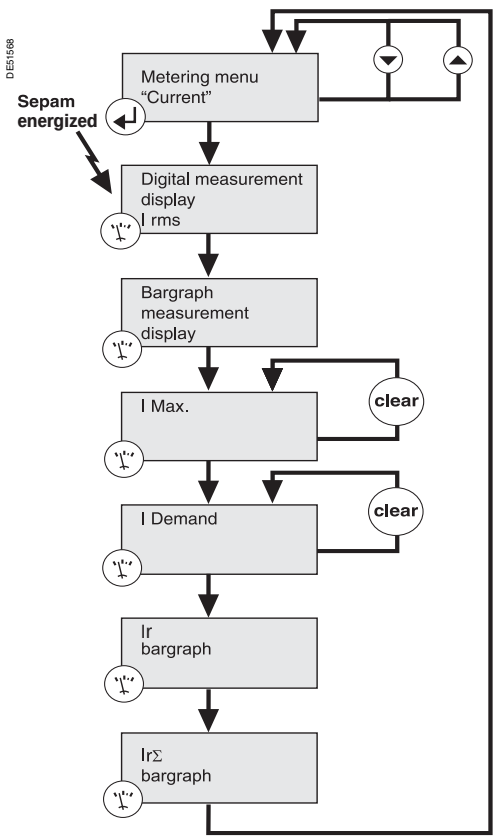
Example: Measurement Loop



Access to Operating Information

1 Select a category by pressing the corresponding key. A selection screen will display the subcategories.

2 Select the desired subcategory with the cursor by pressing ▲ or ▼ . The selected subcategory displays in inverse video.

3 Validate the selection by pressing ↵ . The system displays the first screen that gives operating information of the selected subcategory.

4 Press the displayed category key to go on to the next screen. The diagram opposite shows the progression in a given subcategory.

5 Press ▼ or ▲ when a screen does not display completely.

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Local Operation on the UMI
Operating Functions not Requiring a Password

Resetting Latched Information

reset

Press this button to reset latched information. Sepam™ reset must be confirmed. The alarm messages are not erased.

Acknowledging the Active Alarm

clear

When Sepam™ displays an alarm, this button returns the user to the screen displayed prior to the alarm or to a less recent unacknowledged alarm. Itdoes not reset latched information.

Reset the Peak Demand Measurements

The Sepam™ UMI can reset the following measurement and diagnosis information:

- demand current
- peak demand current
- peak demand power

Use the following steps to reset information:

1 Display the screen showing the information to be reset.
2 Press the reset button.

Clearing the Alarm History

Sepam™ stores the history of the last 16 alarms. To clear this information perform the following steps:

1 Press this button to display the alarm history.
2 Press the **clear** button to clear the alarm history.

Testing LEDs and Display

To check the LEDs and each pixel in the display, press this button for five seconds. The nine LEDs go on successively in a predefined sequence. The pixels in the display will light in a predefined sequence.

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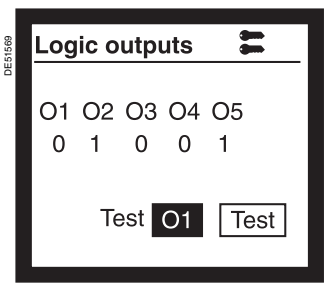

Screen presenting the logic outputs of the base unit and the status of each output, with the possibility of testing each output

Resetting Diagnosis Information

The Sepam™ UMI can reset certain protection functions when you enter the parameter-setting password, such as:

- the number of starts before blocking (this is linked with the "Starts per hour" function ANSI 66)
- heat rise calculated by the "Thermal overload" function (ANSI 49RMS)

Perform the following steps to reset the information:

1. Enter the password for parameter settings.
2. Display the screen showing the information you want to reset.
3. Press (clear) to complete the action.

Testing Logic Outputs

You can change the status of each logic output for five seconds. The check on logic-output connections and switchgear operation is thus simplified.

The screens on the logic outputs can be accessed in the "Sepam™ Information" category and in the "Inputs/outputs" subcategory.

The first screen displays the logic outputs of the base unit. Up to three additional screens present the logic outputs of any additional MES120 modules.

A "Logic Outputs" screen displays the status of all the logic outputs for a given module. Use this screen to change the status of each output in order to check its operation.

Perform the following steps to test a logic output:

1. Enter the password for parameter settings.
2. Display the screen showing the logic output to be tested.
3. Press (↵) to go to the selection field for the output to be tested.
4. Press the cursor keys, (▼) or (▲), to select the desired logic output by scrolling the addresses of the logic outputs in the module
5. Press (↵) to confirm the selected output.
6. Press (▼) or (▲) as needed to go to the [Test] box.
7. Press (↵) to change the status of the logic output for five seconds.

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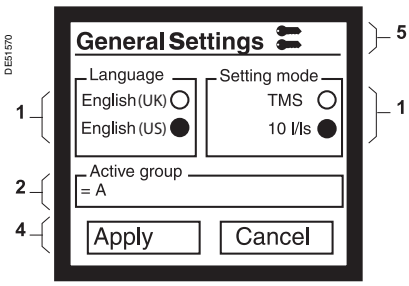
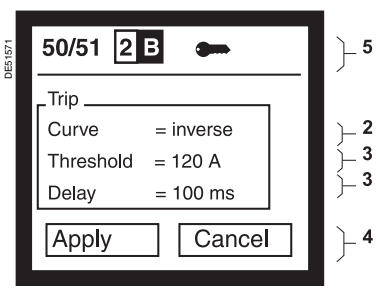
Local Operation on the UMI
Entering Parameter and Protection Settings



General Parameters Screen



Setting screen for the "phase overcurrent" protection function (ANSI 50/51)

***1**. Boolean setting*
***2**. Selection of a value among a number of options*
***3**. Numerical value*
***4**. Boxes for final validation (Apply) or to cancel (Cancel) the procedure*
***5**. Pictogram indicating that the user is authorized to modify parameters and protection settings (after entry of the parameter-setting password)*

Data Entry Principles

Follow these steps to modify parameter or protection settings using the Sepam™ UMI:

1 Enter the proper password for either the protection or the parameter settings (see "Entering Passwords", page 82).
2 Display the screen with the value you want to modify (see "Displaying operating Information", page 83).
3 Modify the values using one of the three entry methods offered, depending on the type of parameter or protection settings:
- entering Boolean values
- selecting a value from a number of options
- entering numerical values

4 Final confirmation of all the new parameter or protection settings for use by Sepam™.

Entering Boolean Values

The Sepam™ display shows Boolean parameters and protection settings as two buttons, representing the two status conditions of Boolean data. For example, the language used for the operating texts on the Sepam™ UMI is a Boolean parameter that can have one of two states:
- UK English
- US English as the local language

Use the following process to modify the value of a Boolean parameter or protection setting:

1 Position the cursor by pressing ▼ or ▲ as needed.
2 Confirm the selection by pressing ↵.

Selecting Values From a List of Options

Certain parameters and protection settings must be selected from a list of possibilities. For example, the type of tripping curve for the "phase overcurrent" protection function is selected from among 16 predefined curves (such as, DT, SIT, VIT, EIT, etc.).

Perform the following steps to select a particular parameter or protection setting:
:
1 Press ▼ or ▲ as needed to position the cursor on the value you want to modify.
2 Press ↵ to confirm your value selection.
3 Press ▼ or ▲ to scroll through the possibilities.
4 Press ↵ to confirm the new value.

Entering Numerical Values

The Sepam™ display shows numerical parameters and protection settings as three digits, with or without the decimal point and the unit symbol.

To modify the value of a numerical parameter or protection setting, follow these steps:

1 Press ▼ or ▲ as needed to position the cursor on the value you want to modify.
2 Press ↵ to position the cursor on the first digit.
3 Use ▼ or ▲ as needed to scroll through the character list. The available characters are the digits from 0 to 9, the decimal point, and a space.
4 Press ↵ again to confirm your choice and proceed to the next digit. After confirming the third digit, the cursor positions on the unit symbol.
5 Use ▼ or ▲ as needed to scroll through the available units.
6 Press ↵ to confirm unit selection.

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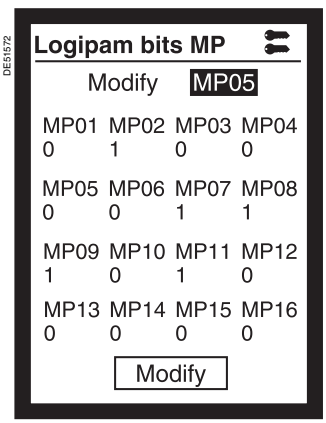
2



Screen for modifying Logipam configuration bits

Final Confirmation of Modifications

After modifying one or more parameters or protection settings on a screen, Sepam™ will ask for confirmation before applying the modifications.

Perform the following steps to confirm any modifications made on a screen:

1 Press ▼ to position the cursor on the **Apply** box at the bottom of the screen
2 Press ↵ to confirm.

Sepam™ then accepts the new parameter or protection settings.

Modifying Logipam Configuration Bits

Logipam configuration bits are Boolean parameters the user can view and modify on the Sepam™ UMI. Four different screens display the 64 configuration bits, MP01 to MP64, in groups of 16 bits each.

The screens on the configuration bits are accessed in the "Sepam™ Information" category and "Logipam" subcategory.

A "Logipam bits MP" screen displays the status of 16 configuration bits. It can be used to change the status of each bit after entering the parameter-setting password.

Perform the following steps to modify a Logipam configuration bit:

1 Enter the password for parameter settings.
2 Display the screen showing the bit you want to modify.
3 Press ↵ to go to the selection field for the bit you want to modify.
4 Press ▼ or ▲ as necessary to select the address of the configuration bit you want to modify.
5 Confirm the selected bit by pressing ↵ .
6 Press ▼ or ▲ to go to the [Modify] box.
7 Press ↵ to change the status of the configuration bit.

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Local Operation on the UMI
Local Control Using the Mimic-Based UMI

PE50486

Local control using the mimic-based UMI

Sepam™ Control Mode

A key-switch on the mimic-based UMI selects the Sepam™ control mode. Three modes are available: Remote, Local, or Test.

In the Remote mode:
- remote control commands are taken into account
- local control commands are disabled, with the exception of the circuit-breaker open command

In the Local mode:
- remote control commands are disabled, with the exception of the circuit-breaker open command
- local control commands are enabled

Select the Test mode for tests on equipment, such as preventive-maintenance operations:
- all functions enabled in Local mode are available in Test mode
- no remote indications (TS) are sent via the communication link

Use the Logipam programming software to customize control-mode processing.

Viewing Device Status on the Animated Mimic Diagram

For safe local control of devices, the mimic-based UMI simultaneously displays all information that operators request.
- The UMI displays a single-line diagram of the equipment that Sepam™ controls and also shows an animated, graphic indication of device status in real time
- The device also displays current, voltage, and power measurements

The local-control mimic diagram can be customized by adapting one of the supplied predefined diagrams or by creating a diagram from scratch.

Local Control of Devices

All the devices that Sepam™ opens and closes can be controlled locally using the mimic-based UMI. The most common interlock conditions are defined by logic equations or by Logipam.

The operating procedure is as follows:

1 Select the Local or Test control mode
2 Use ▲ or ▼ to select the device to control. Sepam™ checks for local control authorization of the device and informs the operator of the result (selection window with a solid line).
3 Press ↵ to confirm selection of the controlled device. The selection window will flash.
4 Control the device by pressing O to open or I to close.

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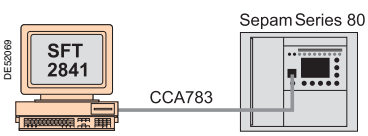
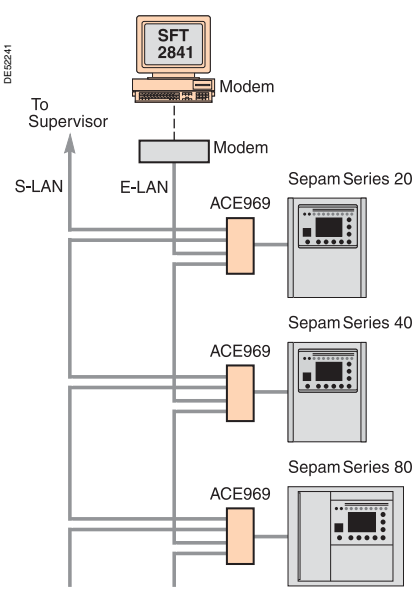
SFT2841 Setup and Operating Software
Welcome Window

SFT2841 Welcome window



SFT2841 connected to a single Sepam™ unit



SFT2841 connected to a Sepam™ network

Description

The SFT2841 welcome window opens when you launch the program. It lets you choose the language for the SFT2841 screens and provides access to the Sepam™ parameter and protection setting files:

In disconnected mode, you can open or create a parameter and protection setting file for a Sepam™ Series 20, Series 40, or Series 80.

When connected to a single Sepam™ unit, you can access the parameter and protection setting file for the Sepam™ unit connected to the PC.

When connected to a Sepam™ network, you can access the parameter and protection setting files for a group of Sepam™ units connected to the PC via a communication network.

Language

SFT2841 software uses English (UK or US), French, or Spanish. You can select the language in the top window.

Using SFT2841 in Disconnected Mode

The Disconnected mode allows you to prepare parameters and settings files prior to commissioning.

These files download later to the Sepam™ units in Connected mode.

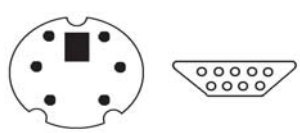
- To create a new parameter and protection setting file, select for the relevant Sepam™ family (Series 20, 40, or 80)
- To open an existing parameter and protection setting file, select for the relevant Sepam™ family (Series 20, 40, or 80)

Using SFT2841 Connected to a Single Sepam™ Unit

You can use the single connect mode during commissioning to:

- upload, download, and modify Sepam™ parameters and settings
- have all measurements and supporting data available for commissioning. The PC loaded with SFT2841 software is connected to the Sepam™ front panel connection port by using a CCA783 cable connected to an RS232 port

Select the icon to open the parameter and protection setting file on the Sepam™ once it is connected to the PC.



6-Pin DIN (Male)	DB-9 (Female)
2 (Rx)	3 (Tx)
1 (Tx)	2 (Rx)
3 (Gnd)	5 (Gnd)

Using SFT2841 Connected to a Sepam™ Network

You can use the Sepam™ network mode during operation to:

- manage the protection system
- check the status of the electrical power system
- diagnose any incident occurring on the electrical power system

The PC with SFT2841 software connects to a group of Sepam™ units through a communication network (serial link, telephone line, or Ethernet). This network forms the E-LAN engineering network.

The connection window allows Sepam™ network configuration and provides access to the parameter and protection setting files of the Sepam™ units on the network.

Select to open the connection window.

See "Configuring a Sepam™ Network" for details of how to configure the E-LAN engineering network from the connection window.

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SFT2841 Setup and Operating Software
Connection Window

Description

The SFT2841 software connection window is used:

- To select an existing Sepam™ network or configure a new one
- To set up the connection to the selected Sepam™ network
- To select one Sepam™ unit from the network and access its parameters, settings, and operation and maintenance information

Configuring Sepam™

You can define several configurations for various Sepam™ installations. A Sepam™ network configuration is identified by a name. Sepam™ saves the configuration information in a file in the SFT2841 installation directory (default: C:\Program Files\Schneider\SFT2841\Net).

Configuring a Sepam™ network consists of two parts:

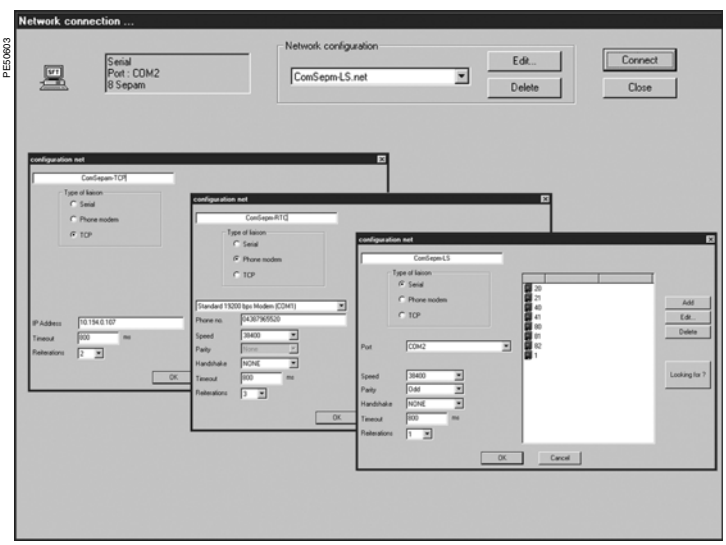
- Configuration of the communication network
- Configuration of the Sepam™ units

Configuring the Communication Network

To configure the communication network, first define:

- The type of link between the PC and the Sepam™ network
- The communication parameters, according to the type of link selected:
  - direct serial link
  - link via Ethernet TCP/IP
  - link via telephone modem

PE50803



Configuration windows for the communication network, according to the type of link: serial link, modem link (STN) or Ethernet link (TCP)

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SFT2841 Set Up and Operating Software
Presentation

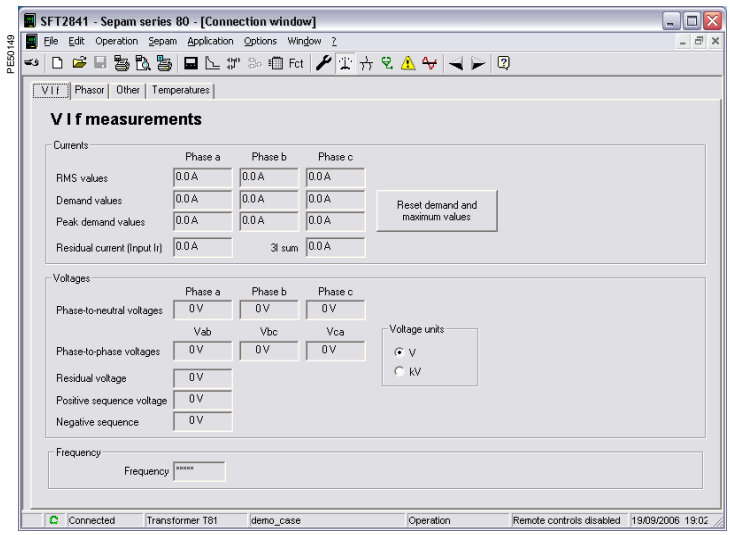
The SFT2841 software operates in the Windows environment (98, NT, 2000, XP).

All data used for the same task is grouped in the same screen for easy operation. Menus and icons are used for fast, direct access to required data.

Normal Operation

The SFT2841 software is designed to provide fast access to all the information. It displays:

- metering and operation data
- alarm messages with the time of appearance (date, hour, min, s, ms)
- diagnosis data such as tripping current, number of switchgear operations, and cumulative breaking current
- protection and parameter settings
- logic status of inputs, outputs, and LEDs.



Example of a measurement display screen

Parameter and Protection Settings (1)

These settings provide the following functions:

- display and setting of all the parameters of each protection function on the same page
- set-up of general settings and Sepam™ data
- set-up of control and monitoring functions
- input data may be prepared ahead of time and transferred into the Sepam™ in a single operation (loading function)

Main Functions

The SFT2841 performs the following main functions:

- changing passwords
- entering general settings (such as ratings, integration period)
- protection settings entry
- assignment modification for control and monitoring functions
- function enabling/disabling
- entering mimic-based UMI parameters
- file saving

Saving

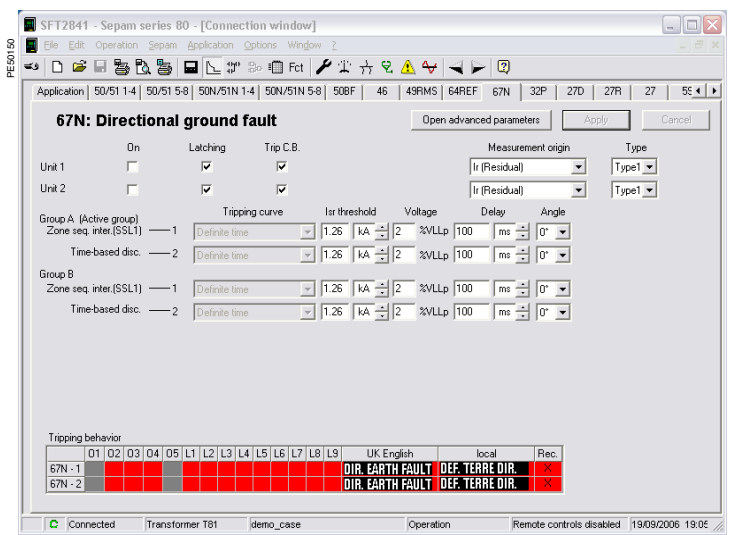
The SFT2841 software also retrieves and displays disturbance recording files.

- Protection and parameter setting data can be saved
- Report printing is available

Operating Assistance

You can access a help section from any SFT2841 screen. It contains all the technical information you need for using or commissioning Sepam™.

(1) Modes accessed via 2 passwords (protection setting level, parameter setting level).



Example of a directional ground fault protection setting screen

63230-216-229-B1

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SFT2841 Set Up and Operating Software
General Screen Organization

Sepam™ uses conventional Windows features to display necessary information. All SFT2841 software screens have the same basic set up. They include:

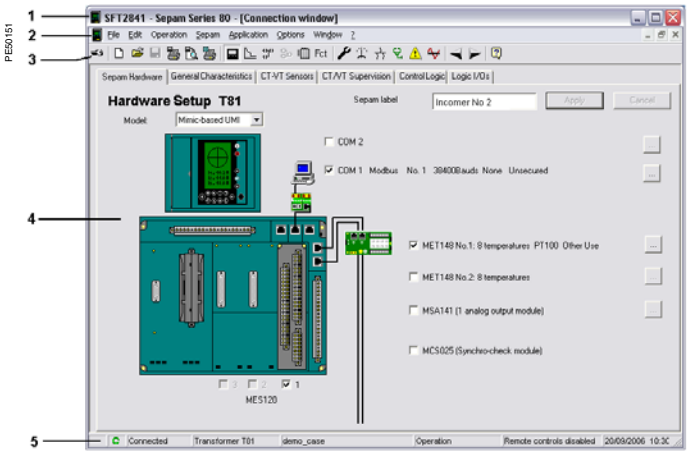
1 the Title bar, with:
- the application name (SFT2841)
- Sepam™ document identification
- corner symbols for window adjustments

2 the Menu bar for access to all software functions (unavailable functions are dimmed).

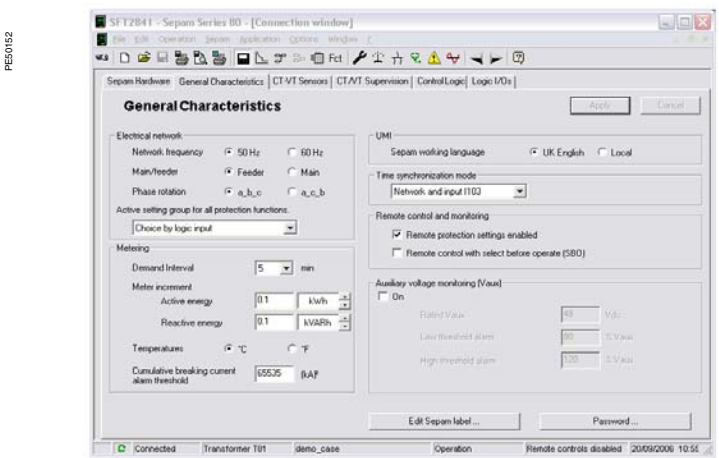
3 the Toolbar, a group of contextual icons for quick access to the main functions (also accessible through the menu bar).

4 the Work zone, available to the user, uses tabbed boxes.

5 A Status bar that provides information about the active document, such as:
- alarm status (on / off)
- identifying the connection window
- SFT2841 operating mode (connected or not)
- Sepam™ type
- identification of Sepam™ edited
- identification level
- Sepam™ operating mode
- PC date and time



Example of hardware configuration screen



Example of general characteristics screen

Guided Navigation

A guided navigation provides ease of entry to Sepam™ parameter and protection settings. It guides users through data input screens in a natural order. Clicking on the two arrow icons in the toolbar controls the screen sequencing in guided mode (**3**):
- ◀ :to return to the previous screen
- ▶ :to go to the next screen

The screens are linked in the following order:

1 Sepam™ hardware configuration
2 General characteristics
3 CT/VT sensors
4 CT/VT circuit supervision
5 Particular characteristics
6 Control logic
7 Logic input/output assignments
8 Setting screens for available protection functions according to the type of Sepam™
9 Logic equation editor (Logipam)
10 The control matrix tabs
11 Disturbance recording function parameter setting
12 Mimic-based UMI setup

On-line Help

The operator may look up on-line help at any time by using the "**?**" command in the menu bar.

Acrobat Reader is required for on-line help. It is provided on the CD.

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SFT2841 Set Up and Operating Software
General Screen Organization
Use

Screen Details

Password identification: entry gives access rights to the parameter and protection setting mode (valid for 5 minutes).

Selecting a new application from a list with factory settings. The file suffix identifies the application. For example, "appli.G87" is for a Generator 87 application

Opening an existing application located in the SFT2841 directory, Sepam™ sub-directory. An application may be selected by choosing the type of file (for example,: file type *.S80, or *. G87 or *.* to obtain the complete list of files)

To save an application, go to SFT2841 directory, Sepam™ sub-directory, and name the file. The application suffix automatically updates.

Configuring and complete or partial printing of the current configuration file

Print preview of the configuration file

Hard-copy of the current screen

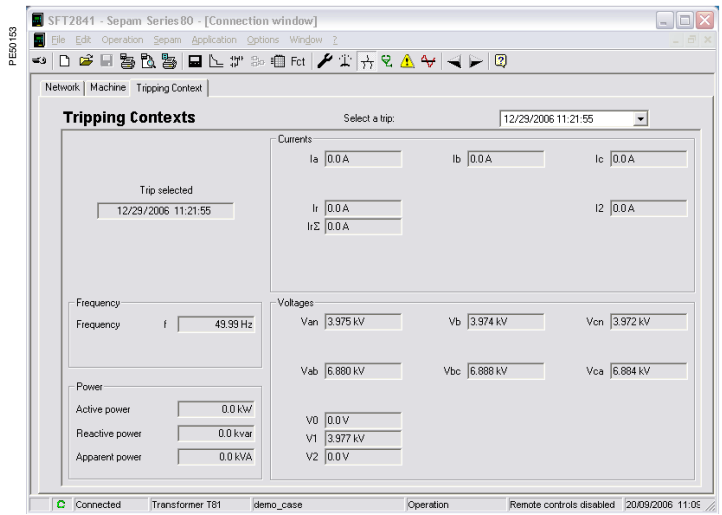
Sepam™ parameter setting:
- "Sepam™ hardware" tab: configuration.
- "General characteristics" tab: setting network, remote control,monitoring, password management and Sepam™ label printing parameter.
- "CT/VT sensors" tab: configuring current and voltage sensors
- "CT/VT supervision" tab: implementating and configuring CT and VT sensor supervision
- "Particular characteristics" tab: transformer and motor/generator rotation speed parameter setting.
- "Control logic" tab: parameter setting logic discrimination, switchgear control, genset shutdown, de-excitation, load shedding, and restart functions
- "Logic I/Os" tab: manage logic input and output assignments

Protection functions:
- "Application" tab: overview of protection functions available in the application with graphical view of single-line diagram. Double click on a protection function label to gain quick access to the setting tab
- One tab per protection function: setting the parameters of each protection function. Gives a mini-matrix for setting outputs, LEDs, and disturbance recording

Create logic equations: See description in "Control and monitoring functions" chapter

Logipam: Program setup and operation. First enter and confirm the program before using the SFT2885 software.

Control matrix: used to assign logic outputs, LEDs and messages to information produced by the protection units, logic inputs and logic equations. This function may also be used to create messages. See "Creating User Messages".



Example of tripping contexts screen

Special functions:
- "Rec" tab: Disturbance-recording function parameter setting
- "Mimic-based UMI" tab: Mimic-based UMI parameter setting.

Sepam™ diagnosis (1)
- "Diagnosis" tab: general characteristics, software version, fault indicator, and Sepam™ time-setting
- "Input, output and LED status" tab: gives status and proposes an output test
- "Remote indication status" tab: remote indication status

Main measurements (1)
- "VIF" tab: voltage, current and frequency values
- "Other" tab: power, energy and rotation speed values
- "Temperatures" tab
- "Phasor" diagram tab

Diagnosis (1)
- Network tab: unbalance / negative sequence, V-I phase displacement, number of phase and ground trips, and total harmonic distortion values
- Machine tab: running hours counter, differential and through current, impedance, I-I' phase displacement, H3 voltage, and thermal overload values
- "Tripping context" tab: gives the last 5 tripping contexts

Switchgear diagnosis: cumulative breaking current, auxiliary voltage and circuit breaker data (1)

Management of alarms with history and time-tagging (1)

Disturbance recording: (1) this function is used to record analog signals and logical states. See "Disturbance recording".

Guided navigation (see previous page)

On-line help (see previous page)

***(1)** These icons are only accessible in "connected to Sepam™" mode.*

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Disconnected Mode

Sepam™ Parameter and Protection Setting

When you use SFT2841 software, setting Sepam™ parameters and protection consists of preparing the Sepam™ file that contains the characteristics pertaining to your application. This file loads into Sepam™ during commissioning.

CAUTION

RISK OF UNINTENDED OPERATION

- Only qualified personnel should configure and set this device in accordance with the protection system study performed prior to installation.
- During installation, commissioning, and following any modification, check Sepam's configuration and protection function settings for consistency with the results of this study.

Failure to follow these instructions can result in equipment damage.

Operating Procedure:

1 Create a Sepam™ file for the type of Sepam™ to be set up. The newly created file contains the factory settings of the Sepam™ parameters and protection functions.
2 Modify the Sepam™ general settings and protection function settings as required:
- all the data relating to the same function are grouped together in the same screen
- it is advisable to enter all the parameters and protection settings in the natural order of the screens proposed by the guided navigation mode

Entering Parameter and Protection Settings

The parameter and protection setting input fields are suited to the type of value:
- choice buttons
- numerical value input fields
- dialogue box (Combo box)

The user must "Apply" or "Cancel" the new values entered before going to the next screen. The consistency of the new values is checked.
- an explicit message identifies inconsistent values and specifies the allowable values
- values that have become inconsistent following a parameter modification are adjusted to the closest consistent value

Connected Mode

Precaution

When using a laptop, remember the risks involving static electricity. The customary precaution consists of discharging in contact with an grounded metal frame before physically connecting the CCA783 cord.

Plugging into Sepam™

1 Plug the 9-pin connector (SUB-D type) into one of the PC communication ports.
2 Configure the PC communication port via the "Communication port" function in the "Options" menu.
3 Plug the 6-pin connector into the connector (round MiniDin type) situated behind the blanking plate on the front panel of Sepam™ or the DSM303 module.

Connection to Sepam™

There are two possible setup connections between SFT2841 and Sepam™:
- "Connection" function in the "File" menu
- choosing "connect to the Sepam™" at SFT2841 start-up

Once the connection with Sepam™ is established, "Connected" appears in the status bar, and you can access the Sepam™ connection window in the work zone.

User Identification

The window intended for the entry of the 4-digit password is activated:
- via the "General characteristics" tab, "Passwords" button
- via the "Identification" function in the "Sepam™" menu

The "Return to Operating mode" function in the "Passwords" tab withdraws access rights to the parameter and protection setting mode

Loading Parameters and Protection Settings

Parameter and protection setting files may only be loaded in the connected Sepam™ in Parameter setting mode.

Once the connection has been established, the procedure for loading a parameter and protection setting file is as follows:
1 Activate the "Load Sepam™" function in the "Sepam™" menu
2 Select the file (*.S80, *.S81, *.S82, *.S84, *.T81, *.T82, *.T87, *.M81, *.M87, *.M88, *.G82, *.G87, *.G88, *.B80, *.B83, or *.C86) according to the type of application) which contains the data to be loaded.

Return to Factory Settings

This operation is only possible in Parameter setting mode in the "Sepam™" menu. All Sepam™ general settings, protection settings and the control matrix return to their default values. The return to factory settings does not erase the logic equations. The logic equation editor must be used to delete them.

Unloading Parameter and Protection Settings

The connected Sepam™ parameter and protection setting file may only be unloaded in Operating mode.

Once the connection has been established, use the following procedure to unload a parameter and protection setting file:

1 Activate the "Unload Sepam™" function in the "Sepam™" menu
2 Select the file that contains the unloaded data
3 Acknowledge the end of operation report.

Local Sepam™ Operation

Connected to Sepam™, SFT2841 offers all the local operating functions available in the advanced UMI screen, plus the following functions:
- setting of Sepam's internal clock, via the "Sepam™ diagnosis" tab
- implementation of the disturbance recording function: enabling/disabling of the function, retrieval of Sepam™ files, start-up of SFT2826
- consultation of the history of the last 250 Sepam™ alarms, with time-tagging
- access to Sepam™ diagnostic data, in the "Sepam™" tab box, included in "Sepam™ diagnosis"
- in Parameter setting mode, switchgear diagnosis values may be modified: operation counter and cumulative breaking current to reset the values after a breaking device is changed

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The control matrix allows you to create user messages.

Use or "Application / Set control matrix" menu).

Perform these steps to generate user messages:

1 When the matrix is displayed, select the **Events** tab.
2 Double-click on the empty box of the message to be created, or on an existing message to modify it.

A new screen may be used to:
- create a new user message
- click on the **Create messages** button
- modify the message you have created or an existing user message

3 Select the message window.
4 Click on the **Modify** button. You can use an editing or bitmap window to create text or drawings.
5 Assign the message to the line in the control matrix:
6 Select **Message No.** if it is not already selected.
7 Select the new predefined or user message in the corresponding **No** column.
8 Click on **Assign**.
9 Confirm your choice by clicking on the **OK** button.

Example of message creation screen

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SFT2841 Setting and Operating Software
Disturbance Recording

Use the Fct icon to setup disturbance recording and follow these steps:

1 Activate the function.
2 Set the following parameters:
- number of recordings
- duration of each recording
- number of samples stored per period
- number of Pretrig periods (number of periods stored before the disturbance recording triggering event)

3 Type the list of logic I/Os that should appear in the disturbance recording.

If a parameter is changed (number of recordings, duration of a recording, number of Pretrig periods), all the recordings already saved will be erased (a warning message is displayed).

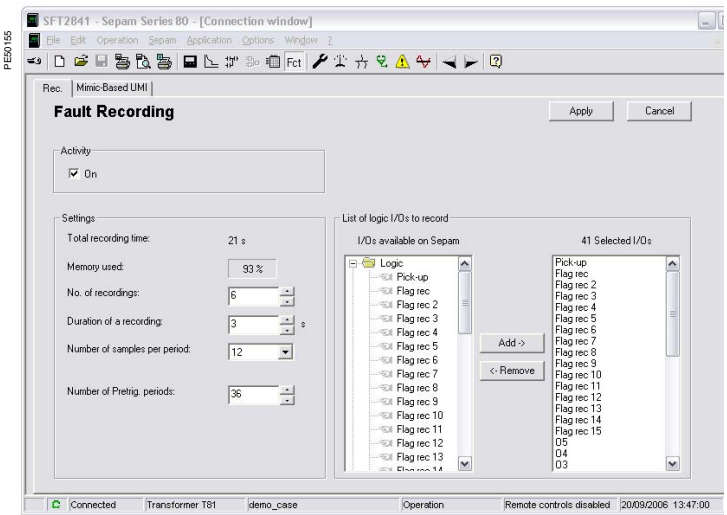
Changes made in the list of logic I/Os do not affect existing recordings.

4 Click on the **Apply** button.

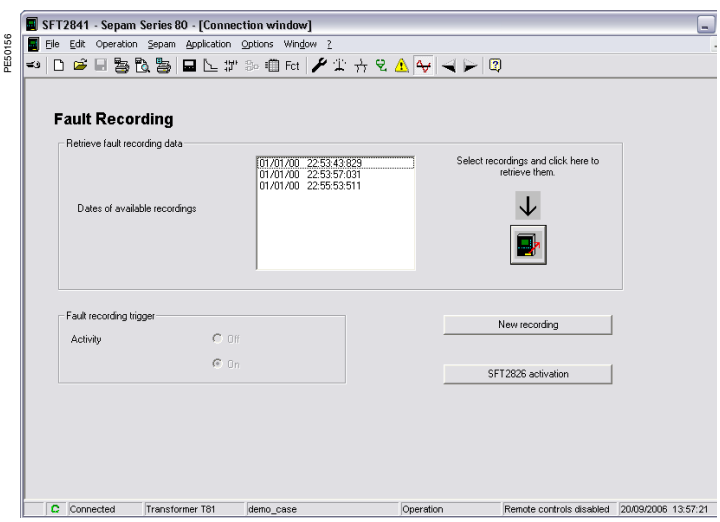
Disturbance recordings may be displayed by clicking on the icon.
Each recording is identified in the list by the date.

For **Manual disturbance recording**, click on the "New recording" button and a new dated item appears in the list.

For **Displaying recordings**, select one or more disturbance recordings, and click on the "Retrieve" button. This opens a window which allows uploading and saving the disturbance record files.



Example of disturbance recording configuration screen



Example of disturbance recording display screen

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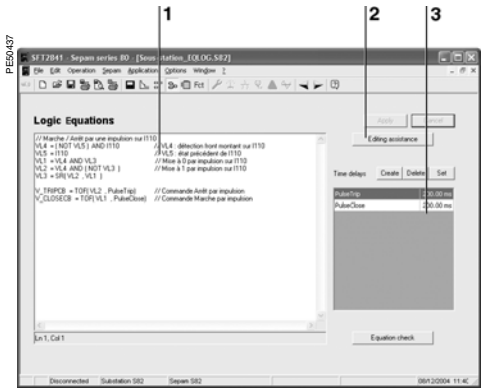
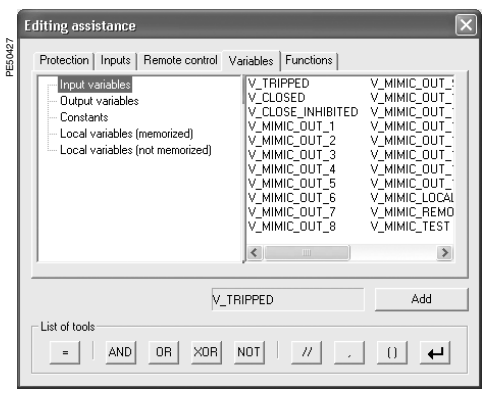
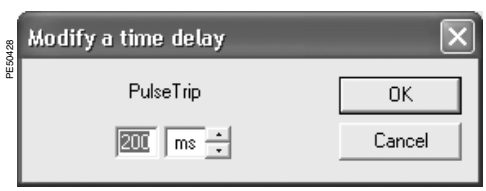
SFT2841 Setting and Operating Software
Logic-Equation Editing



Logic-equation editor screen



Editing assistance tool



Time delay editor

Presentation

Logic-equation editing consists of:
- entry and checks on logic equations
- setting the delays used in the logic equations
- loading the logic equations in Sepam™

The logic-equation editor of the SFT2841 software is accessed via the icon. It is authorized only when the Logipam program linked to the Sepam™ configuration is not installed.

The logic-equation editor includes:
- a zone to enter and display the logic equations (**1**)
- an editing assistance tool (**2**)
- a tool for setting time delays (**3**)

Entering Logic Equations

The Sepam™ Series 80 Functions Manual contains the syntax required for logic equations in the "Control and Monitoring Functions" section of the Series 80 Reference Manual, 63230-216-230.

Logic equations are entered in text either directly in the equation entry zone, or by using the editing assistance tool.

The editing assistance tool offers guided access to variables, operators, and functions. In the tab sheets and tree structures, the user can select program elements and click the "Add" button. The selected element is placed in the entry zone.

Checking Logic Equations

You can validate logic equation syntax by clicking:
- the "Equation check" button during entry of logic equations
- the "Apply" button during final confirmation of the logic equations entered

An error message is displayed if the check detects an error. The message indicates the type of error and the line containing the error.

Nota : *The "Equation check" button only verifies the logic is correct. It is up to the user to determine if the equation is valid (i.e. the correct inputs, timers, variables are used).*

Setting Time Delays

Time delays can be entered directly in a logic equation.

Example: V1=TON(VL1, 100), "On" time delay, set to delay the shift to 1 of variable VL1 by 100 ms.

To improve equation legibility and facilitate time delay settings, use the time delay editor to:
- create a time delay. Indicate its duration and name (used in writing the logic equation)
- delete a time delay
- modify the duration of a time delay without making changes in the equation entry zone
- show the list of delays used in the logic equations with names and durations

Example: Create SwitchOnDelay with a duration of 100 ms.
In the entry zone, use the time delay: V1=TON(VL1, SwitchOnDelay).

Loading Logic Equations in Sepam™

Logic equations transfer to Sepam™ in Connected mode:
- directly by clicking the **Apply** button
- when a configuration file containing logic equations entered in disconnected mode is loaded

In both cases, loading results in a short interruption in Sepam™ operation and automatic restart at the end of loading.

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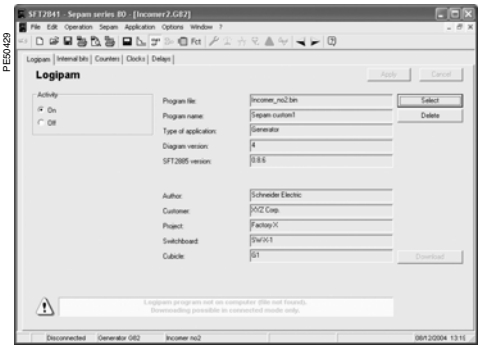
SFT2841 Setting and Operating Software
Setting Up and Operating a Logipam Program



Logipam screen.

Presentation

The Logipam screen in the SFT2841 software is used to:
- link a Logipam program to the configuration of a Sepam™
- set program parameters
- view the internal program variables to assist in program set-up

Note: *Use the SFT2885 software to first enter and confirm Logipam.*

Press to access the Logipam screen.

The Logipam screen is accessed in Connected mode with a Sepam™ if it has the Logipam SFT080 option. In disconnected mode, the Logipam screen is still accessible, but the configuration files containing a Logipam program are loaded exclusively to Sepam™ units with the SFT080 option.

The Logipam screen has five tabs:
- **Logipam:** selection of the program and its operating mode
- **Internal bits:** view the internal bits and set the configuration bits
- **Counters:** view the current value and set the counters
- **Delays:** set time delays
- **Clocks:** set the clocks

Linking Logipam to a Sepam™ Configuration

Logipam links to a Sepam™ configuration by selecting the program file. Use the **Select** button on the Logipam tab sheet.

The programs are stored in the Logipam subdirectory of the SFT2841 installation directory (by default C:\Program Files\Schneider\SFT2841\Logipam). They have the extension ***.bin**.

Once the program has been selected, the program properties display (name, version, author, installation characteristics, etc.).

The "Apply" Button

In Disconnected mode, the **Apply** button stores the name of the Logipam program in the Sepam™ configuration file. The program is then loaded in Sepam™ at the same time as the configuration file.

In Connected mode, it stores the name of the Logipam program in the Sepam™ configuration file and loads the program in Sepam™.

The Delete Button

The **Delete** button eliminates the link between the Logipam program and the configuration file. In Connected mode, the name of the Logipam program is deleted in the Sepam™ memory cartridge when the **Apply** button is clicked.

Selecting the operating mode of Logipam:
- **On:** the program runs immediately after it is loaded
- **Off:** the program does not run and program outputs remain set to 0

You can also temporarily postpone Logipam program processing if the program has not been fully set up.

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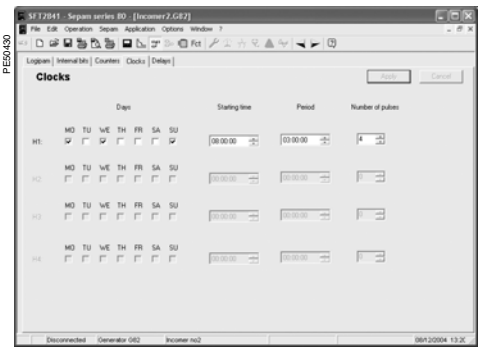
SFT2841 Setting and Operating Software
Setting Up and Operating a Logipam Program

PE50430



Logipam clock settings screen

Setting up a Logipam Program

In order to adapt the program to user's needs, you can set up the following Logipam information on the tabs of the Logipam screen in the SFT2841 software:

- values of the configuration bits
- duration of time delays
- counter set points
- clock settings

As with other Sepam™ parameters, the set values save to the configuration file in disconnected mode and to Sepam™ in connected mode.

Viewing Logipam Internal Data

Check program operation by viewing the following information on the tab sheets of the Logipam screen:

- values of the configuration bits
- values of the saved internal bits
- values of the non-saved internal bits
- current counter values

Updating Logipam

The SFT2841 constantly checks for a more recent version of the Logipam program. When a check yields positive results, an update proposal appears on the Logipam tab sheet with two options:

- maintain all settings as modified using the SFT2841 program or the Sepam™ display
- return to the default settings set up in the program

Uploading Logipam

You can upload the Logipam program from Sepam™ by clicking the "Upload" button on the Logipam tab sheet. Once uploaded, the program can be openec by the SFT2885 software for viewing and modification.

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SFT2841 Setting and Operating Software
Default Settings

Sepam™ uses default factory settings on the first use. You can return to the default settings at any time by using the **Factory Settings** function in the SFT2841 software. These settings are also used to initialize the SFT2841 software setting files.

Parameter	Default Value
Hardware Configuration	
Model	Integrated UMI
Identification	Sepam™ xxx
COM1, COM2	Off
MET148-2 No. 1, 2	Off
MSA141	Off
MES120 No. 1, 2, 3	Off
MCS025	Off
General Characteristics	
Frequency	50 Hz
Main/feeder	G82, G87, G88, T81, T82, T87 applications: main S80, S81, S82, S84, M81, M87, M88, B80, B83, C86 applications: feeder
Phase rotation direction	a_b_c
Group of settings	Group A
Remote protection setting enabled	Off
Remote control with select before operate (SBO)	Off
Integration period	5 min
Active-energy increment	0.1 kWh
Reactive-energy increment	0.1 kVARh
Temperature	°C
Sepam™ working language	English
Time synchronization mode	None
Auxiliary voltage monitoring	Off
Protection setting password	0000
Parameter setting password	0000
Cumulative breaking current alarm threshold	65535 kA²
CT-VT Sensors	
Single-line type	1
I - CT rating	5A
I - Number of CTs	Ia, Ib, Ic
I – Rated current (In)	630 A
I - Base current (Ib)	630 A
Ir – Residual current	None
I'r – Residual current	None
I' - CT rating	5A
I' - Number of CTs	Ia, Ib, Ic
I' – Rated current (I'n)	630A (except C86: I'n = 5A)
I' - Base current (I'b)	630A
V – Number of VTs	Van, Vbn, Vcn
V - Rated primary voltage (Unp)	20 kV
V - Rated secondary voltage (Uns)	100 V
Vr	3V sum
Vnt	None
V' – Number of VTs	V'an, V'bn, V'cn (B83) V'ab (B80)
V' - Rated primary voltage ($V'_{LL}p$)	20 kV
V' - Rated secondary voltage ($V'_{LL}s$)	100 V
V'r	3V sum
Particular Characteristics	
Transformer present	T87, G88, M88: yes Other applications: no
Rated voltage $V_{LL}N1$	20 kV
Rated voltage $V_{LL}N2$	20 kV
Rated power	30 MVA
Vector shift	0
Rated speed	3000 rpm
Zero speed threshold	5 %
Pulses per rotation	1
Number of capacitor steps	1
Type of connection	Wye
Capacitor step ratio	1,1,1,1

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SFT2841 Setting and Operating Software
Default Settings

Parameter	Default Value
Control Logic	
Switchgear control	On, circuit breaker
Logic discrimination	Off
Genset shutdown	Off
De-excitation	Off
Load shedding	Off
Restart	Off
Capacitor step control	Off
Automatic transfer	Off
Logic I/O Assignment	
O1, O3	On, NO, permanent
O2, O5	On, NC, permanent
O4	Off
Protection	
Activity	All protection functions are "off"
Latching	21B, 27D, 32P, 32Q, 38/49T, 40, 46, 48/51LR, 49RMS, 50BF, 50/27, 50/51, 50N/51N, 50V/51V, 51C, 64REF, 67, 67N, 78PS, 87M, 87T
Participation in switchgear control	21B, 32P, 32Q, 37, 38/49T, 40, 46, 48/51LR, 49RMS, 50/27, 50/51, 50N/51N, 50V/51V, 64REF, 67, 67N, 78PS, 87M, 87T
Genset shutdown	12, 40, 50/51 (units 6, 7), 50N/51N (units 6, 7), 59N, 64REF, 67, 67N, 87M, 87T
De-excitation	12, 40, 50/51 (units 6, 7), 50N/51N (units 6, 7), 59, 59N, 64REF, 67, 67N, 87M, 87T
Setting	Approximate values consistent with general characteristics by default
Matrix	
LED	According to front panel marking
Disturbance recording	Pick-up All protection functions except for 14, 27R, 38/49T, 48/51LR, 49RMS, 50BF, 51C, 66
Logic outputs	O1: tripping O2: block closing O3: closing O5: watchdog
Disturbance Recording	
Activity	On
Number of recordings	6
Duration of a recording	3
Number of samples per period	12
Number of Pretrig periods	36

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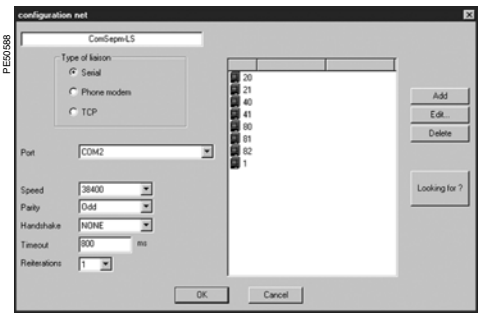
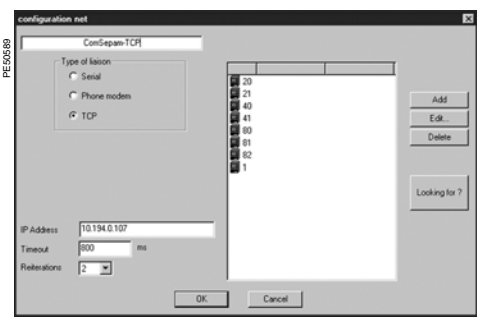
SFT2841 Setting and Operating Software
Configuring Sepam™

PE50588



Configuration window for the serial link communication network

PE50589



Configuration window for the Ethernet TCP/IP communication network

Direct Serial Link

The Sepam™ units connect to an RS485 (or fiberoptic) multidrop network. Depending on the serial link interfaces available on the PC, the PC either connects directly to the RS485 network (or fiberoptic hub), or through an RS232/RS485 converter (or fiber-optic converter).

The communication parameters you must define are:

- port: communication port used on the PC
- speed: 4800, 9600, 19200, or 38400 baud
- parity: None, Even, or Odd
- handshake: None, RTS, or RTS-CTS
- time-out: from 100 to 3000 ms
- number of retries: 6 maximum

Ethernet TCP/IP Link

The Sepam™ units connect to an RS485 multidrop network over an Ethernet Modbus TCP/IP gateway, such as an EGX gateway.

Modbus TCP/IP Gateway Configuration

See the setup manual for the gateway used. The gateway should be assigned an IP address.

The configuration parameters for the gateway's RS485 interface are defined in accordance with the Sepam™ communication interface configuration:

- speed: 4800, 9600, 19200, or 38400 baud
- character format: 8 data bits + 1 stop bit + parity (none, even, odd)

SFT2841 Communication Configuration

When configuring a Sepam™ network on SFT2841, you must define the following communication parameters:

- **IP address:** IP address of the remote Modbus TCP/IP gateway
- **time-out:** from 100 to 3000 ms
  A time-out of between 800 ms and 1000 ms is sufficient in most installations. Communication via the TCP/IP gateway may slow if other applications want Modbus TCP/IP access at the same time. The time-out value should increase (2 to 3 seconds)
- **number of retries:** 6 maximum

Note 1: *SFT2841 uses the Modbus TCP/IP communication protocol.*
Although communication is IP-based, use of SFT2841 is restricted to a local installation network based on an Ethernet network (LAN – Local Area Network).

The operation of SFT2841 over a WAN (Wide Area Network) cannot be guaranteed because of the presence of some routers or firewalls that may reject the Modbus protocol, causing communication times that would be incompatible with Sepam™.

Note 2: *SFT2841 allows Sepam™ protection settings to be modified, and direct activation of the outputs. These operations, which could involve the operation of electrical switchgear (opening and closing), and thus risk the safety of people and installations, are protected by the Sepam™ password. In addition to this protection, the E-LANs and S-LANs must be designed as private networks, protected from external actions by all suitable methods.*

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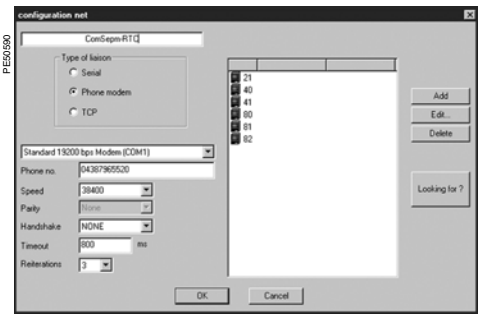
SFT2841 Setting and Operating Software
Configuring Sepam™

PE50590



Configuration window for the communication network by telephone modem

Link via Telephone Modem

The Sepam™ units connect to an RS485 multidrop network using an industrial STN modem.

Modem configuration occurs in one of two ways:
- through AT commands from a PC using HyperTerminal
- the configuration tool supplied with the modem
- switch settings from the modem manufacturer's manual

The PC may use an internal or external modem as its calling modem. Install and configure this modem according to Windows modem installation procedure.

Modem Configuration in SFT2841

When you configure Sepam™, SFT2841 displays a list of all modems installed on the PC.

The communication parameters you must define are:
- **modem:** select one of the modems listed by SFT2841
- **telephone no.:** the number of the remote modem to be called
- **speed:** 4800, 9600, 19200, or 38400 baud
- **parity:** none (not adjustable)
- **handshake:** none, RTS or RTS-CTS
- **time-out:** from 100 to 3000 ms
  Communication by modem and telephone network slows because of the transit time through the modems. A time-out value of 800 ms to 1000 ms is sufficient in most 38400 baud installations. In some cases, telephone network quality may require a slower speed (9600 or 4800 bauds). The time-out value should then be increased (2 to 3 seconds).
- **number of retries:** from 1 to 6

Note: *The speed and parity of the calling modem must be configured under Windows with the same values as for SFT2841.*

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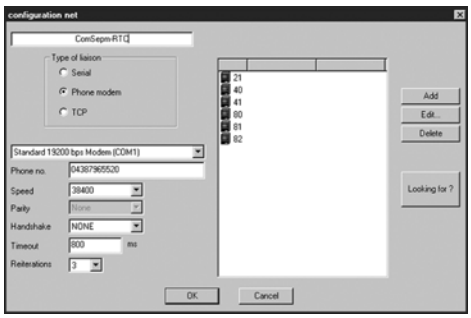
SFT2841 Setting and Operating Software
Configuring Sepam™



Configuration window for the communication network via telephone modem

Called Modem Configuration

The modem on the Sepam™ side is the called modem. Confugure this modem first, either by AT commands from a PC using HyperTerminal (the configuration tool supplied with the modem) or by setting switches (see the modem manufacturer's manual).

Modem RS485 Interface

The configuration parameters for the modem's RS485 interface are defined in accordance with the Sepam™ communication interface configuration:

- speed: 4800, 9600, 19200, or 38400 baud
- character format: 8 data bits + 1 stop bit + parity (none, even, odd)

Telephone Network Interface

Modern modems offer sophisticated features such as checking telephone line quality, error correction, and data compression. These options are not appropriate for communication between SFT2841 and Sepam™, which is based on the Modbus RTU protocol. They can adversely affect communication performance.

You should pay attention to the following items:

1. Invalidate the error correction, data compression, and telephone line quality monitoring options.
2. Use the same end-to-end communication speed between:
   - the Sepam™ network and the called modem
   - the called modem (Sepam™ side) and the calling modem (PC side)
   - the PC and the calling modem (see recommended configurations table)

Sepam™ Network	Telephone Network	PC Modem Interface
38400 baud	V34 modulation, 33600 baud	38400 baud
19200 baud	V34 modulation, 19200 baud	19200 baud
9600 baud	V32 modulation, 9600 baud	9600 baud

Industrial Configuration Profile

The following table shows the main characteristics of the Sepam™-side modem. These characteristics match a configuration profile commonly known as an "industrial profile," as opposed to the configuration of modems used in offices.

Depending on the type of modem, configuration occurs by AT commands from a PC using HyperTerminal, a configuration tool supplied with the modem, or by switch settings (see the modem manufacturer's manual).

Industrial Profile Configuration Characteristics	AT Command
Transmission in buffered mode, without error correction	\N0 (force &Q6)
Data compression deactivated	%C0
Line quality monitoring deactivated	%E0
DTR signal assumed to be permanently off (allows the modem connection to be established automatically on an incoming call)	&D0
CD signal off when carrier is present	&C1
All reports made to Sepam™ blocked	Q1
Character echo suppression	E0
No flow control	&K0

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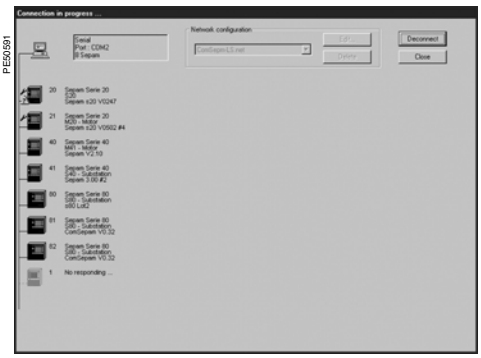
SFT2841 Setting and Operating Software
Configuring Sepam™

PE50591



Sepam™ network connected to SFT2841

PE50592

Access to parameters and settings for a Sepam™ Series 80 connected to a communication network

Identifying Sepam™ Units Connected to the Communication Network

The Sepam™ units connected to the communication network are identified by their Modbus address.

You can configure these addresses in either of the following ways:

- Manually, one by one:
  - use the **Add** button to define a new Sepam™ device; it is allocated a default Modbus address
  - use the **Edit** button to modify the Modbus address if necessary
  - use the **Delete** button to remove a device from the configuration
- Automatically, by running an automatic search of the Sepam™ units connected:
  - the **Automatic search / Stop search** button starts or interrupts the search
  - when SFT2841 recognizes a Sepam™ unit, its Modbus address and type are shown on screen
  - when a Modbus device other than Sepam™ responds to SFT2841, its Modbus address is displayed. The text **???** indicates the device is not a Sepam™

Press the **OK** button to close the UMI window and save the Sepam™ network configuration settings.

Access to Sepam™ Information

To establish communication between SFT2841 and a Sepam™ network, select the Sepam™ network configuration you want, and press **Connect**.

The connection window displays the Sepam™ network. SFT2841 polls all the equipment defined in the selected configuration. An icon represents each queried Sepam™:

Sepam™ Series 20 or Series 40 connected to the network

Sepam™ Series 80 connected to the network

Sepam™ configured but not connected to the network

device other than Sepam™ connected to the network

A summary report of each detected Sepam™ is also displayed:

- Sepam™ Modbus address
- Type of application and Sepam™ identification
- Any alarms present
- Any minor/major faults present

Click the appropriate icon to access parameters, settings and operation, and maintenance information for a particular Sepam™. SFT2841 will establish a point-to-point connection with the selected Sepam™.

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SFT2841 Software Mimic-Diagram Editor
Presentation

Description

SFT2841 Sepam™ setting and operating software includes a mimic-diagram editor you can use to personalize the mimic diagram for local control on the mimic-based UMI of Sepam™ Series 80 units.

A mimic-diagram or single-line diagram is a simplified diagram of an electrical installation. It is made up of a fixed background on which symbols and measurements are placed.

The mimic-diagram editor can be used to:
- create a fixed bitmap background (128 x 240 pixels) using standard drawing software
- create animated symbols or use predefined animated symbols to represent the electrotechnical devices or other objects
- assign the logic inputs or internal status conditions that modify the animated symbols. For example, the logic inputs for the circuit-breaker position must be assigned to the circuit-breaker symbol to enable the display of the open and closed conditions
- assign the logic outputs or internal status conditions that activate when opening or closing commands are issued for the symbol
- display current, voltage, and power measurements on the mimic diagram

Mimic-Diagram and Symbols

The symbols making up the mimic-diagram constitute the interface between the mimic-based UMI and other Sepam™ control functions.

There are three types of symbols:
- **A Fixed symbol:** represents the electrotechnical devices that are neither animated or controlled such as a transformer
- **An Animated symbol:** with one or two inputs represents the electrotechnical devices that change on the mimic diagram, depending on the symbol inputs, but cannot be controlled via the Sepam™ mimic-based UMI.

  This type of symbol is used for switch-disconnectors without remote controls.

- **A Controlled symbol:** with one or two inputs/outputs represents the electrotechnical devices that change on the mimic diagram, depending on the symbol inputs, and can be controlled via the Sepam™ mimic-based UMI. This type of symbol is used for circuit breakers

  The symbol outputs are used to control the electrotechnical device:
  - directly via the Sepam™ logic outputs
  - by the switchgear control function
  - by logic equations or the Logipam program

Local Control using Symbols

Controlled - 1 input/output and **Controlled - 2 input/output** symbols are used to control the switchgear that corresponds to the symbol via the Sepam™ mimic-based UMI.

Control Symbols with One Output
Controlled - 1 input/output symbols have one control output. The output remains in the last state to which it was commanded.

A new command causes in a change in the output state.

Control Symbols with Two Outputs
Controlled - 2 input/output symbols have two control outputs for opening and closing of the symbolized device. A command on the mimic-based UMI sends a 300 ms pulse on the controlled output.

Blocking Commands
Controlled - 1 input/output and **Controlled - 2 input/output** symbols have two blocking inputs that block opening and closing commands when set to "1". This makes it possible to create interlocking systems or other command-disabling systems that the UMI takes into account.

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SFT2841 Software Mimic-Diagram Editor Presentation

Symbol Animation

Symbols change, depending on the value of their inputs. A drawing corresponds to each state. Animation occurs by changing the symbol each time the state changes.

Symbol inputs are assigned directly to the Sepam™ inputs to indicate the position of the switchgear in the symbol.

Animated Symbols with Two Inputs

Animated - 2 inputs and **Controlled - 2 inputs/outputs** symbols are animated symbols with two inputs, one open and the other closed.

This is the most common situation in representing switchgear positions. The symbol has three states or three graphic representations: open, closed, and unknown. The last is obtained when the inputs are unmatched. It is impossible to determine the position of the switchgear in such a case.

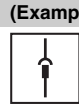
Symbol Inputs	Symbol State	Graphic Representation (Example)
Input 1 (open) = 1 Input 2 (closed) = 0	Open	
Input 1 (open) = 0 Input 2 (closed) = 1	Closed	
Input 1 (open) = 0 Input 2 (closed) = 0	Unknown	
Input 1 (open) = 1 Input 2 (closed) = 1	Unknown	

Animated Symbols with One Input

Animated -1 input and **Controlled -1 input/output** symbols are animated symbols with one input. The value of the input determines the state of the symbol:

- input set to 0 = inactive
- input set to 1 = active

This type of symbol presents information simply, like the racked-out position of a circuit breaker.

Symbol Inputs	Symbol State	Graphic Representation (Example)
Input = 0	Inactive	
Input = 1	Active	

Symbol Inputs/Outputs

Depending on the desired operation of the mimic-based UMI, Sepam™ variables must be assigned to the inputs of animated symbols and the inputs/outputs of controlled symbols.

Sepam™ Variables Assigned to Symbol Inputs

Sepam™ Variables		Name	Use
Logic inputs		Ixxx	Symbol animation directly based on device positions
Outputs of predefined functions	Switchgear control	V_CLOSE_INHIBITED	Circuit-breaker operation disabled
	Position of key on the front panel of Sepam™	V_MIMIC_LOCAL, V_MIMIC_REMOTE, V_MIMIC_TEST	■ Representation of key position ■ Operation disabled depending on the control mode
	Logic equations or Logipam program	V_MIMIC_IN_1 to V_MIMIC_IN_16	■ Representation of Sepam™ internal status conditions ■ Cases where operation is disabled

Sepam™ Variables to be Assigned to Symbol Outputs

Sepam™ Variables		Name	Use
Logic outputs		Oxxx	Direct control of devices
Inputs of predefined functions	Switchgear control	V_MIMIC_CLOSE_CB V_MIMIC_OPEN_CB	Circuit-breaker control using the switchgear-control function through the mimic-based UMI
	Logic equations or Logipam program	V_MIMIC_OUT1 to V_MIMIC_OUT16	Command processing by logic functions: interlocking, command sequence, etc.

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SFT2841 Software
Mimic-Diagram Editor
General Screen Organization

Mimic-Diagram Editor Main Screen

The default settings for main screen of the mimic-diagram editor are organized as presented below.

1 The title bar, with:
- the name of the application
- identification of the document
- handles for window adjustments

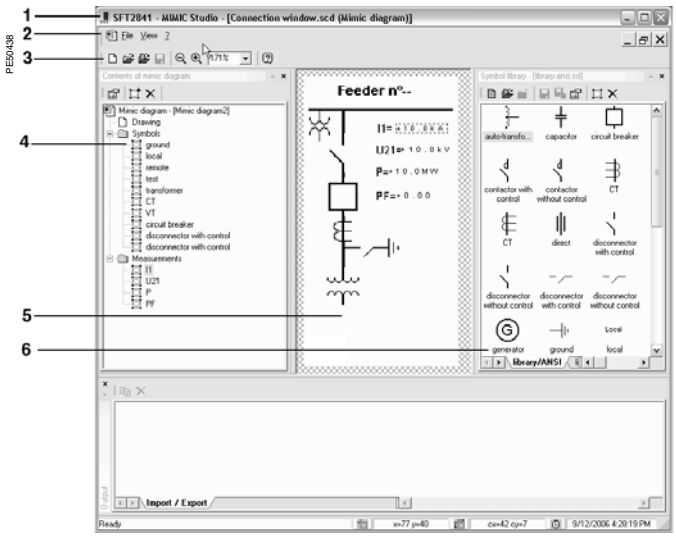
2 The menu bar for access to all functions

3 The main toolbar, which has contextual icons for quick access to the main functions

4 The mimic-diagram explorer, with a list of symbols and measurements in the current mimic diagram

5 A drawing zone showing the diagram displayed on the mimic-based UMI. This is the work zone where the user can place symbols and measurements

6 The symbol library containing the symbols used in the mimic diagram



Main Toolbar Icons

- Select a new diagram in the library of existing diagrams
- Open an existing diagram
- Open a symbol library
- Save a diagram
- Zoom forward and back
- Display the value of the zoom in %. You can also directly enter the value of the zoom
- On-line help

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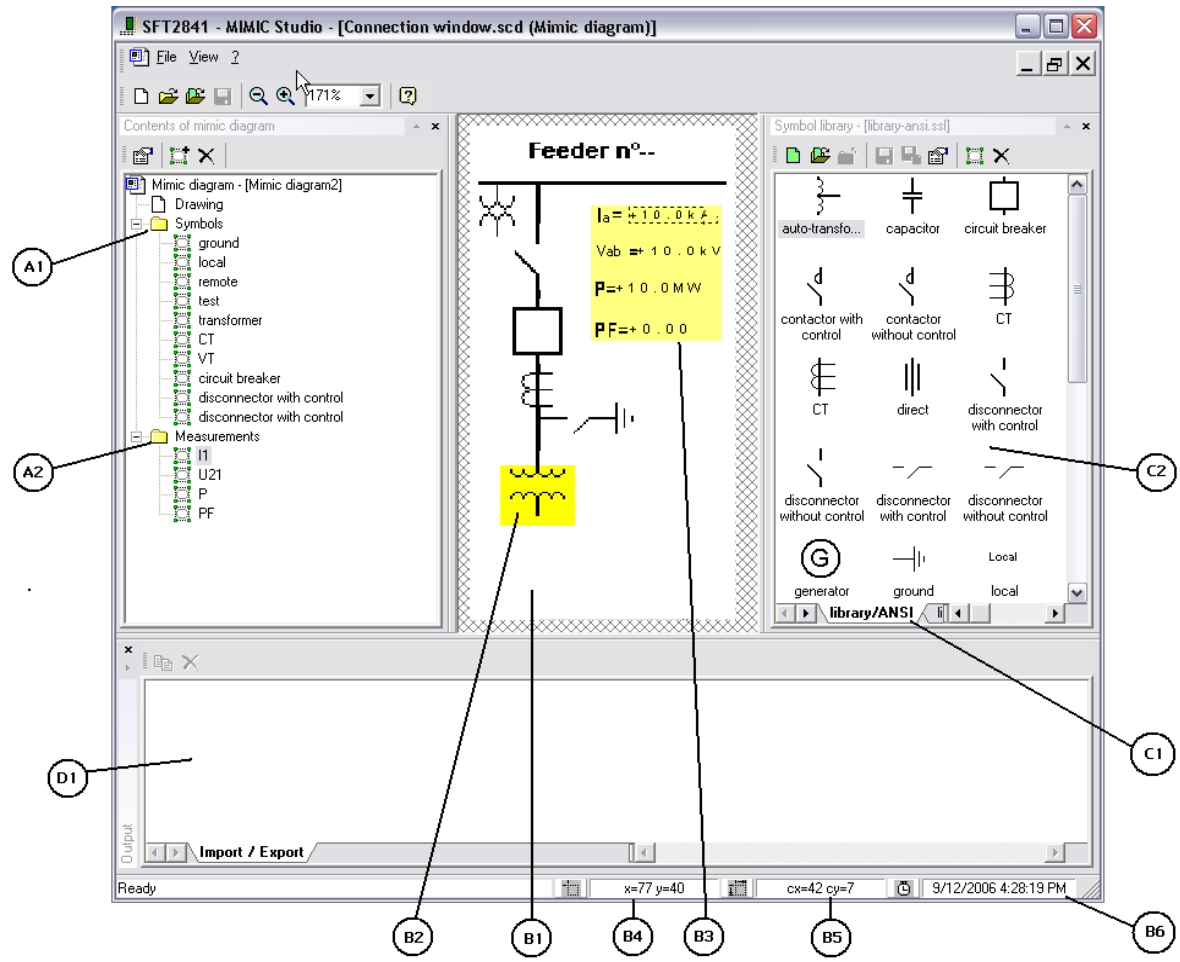
SFT2841 Software
Mimic-Diagram Editor
General Screen Organization

PE50439



Mimic-Diagram Explorer		Mimic-Diagram Editor		Symbol Library	
Description		**Description**		**Description**	
A1	List of symbols contained in the mimic diagram	**B1**	Mimic diagram. Double-click the diagram to open the drawing software	**C1**	Tabs to select a symbol library
A2	List of measurements contained in the mimic diagram	**B2**	Symbol contained in the mimic diagram	**C2**	Symbols in the library
Double-click a symbol or measurement to open the "Symbol properties" window.		**B3**	Measurements contained in the mimic diagram		Double-click a symbol to open the "Symbol properties" window.
				D1	Import/Export dialog box
Toolbar Icons			Double-click a symbol or measurement to open the "Symbol properties" window.	**Toolbar Icons**	
	Read or modify diagram properties				Create a new symbol library
	Copy a symbol from the library		Click and hold to move a symbol or a measurement in the diagram.		Open a symbol library
	Delete a symbol				Close a symbol library
		B4	Coordinates of the selected symbol or measurement in pixels		Save the symbol library to the same file or a different file
		B5	Dimensions of the selected symbol or measurement in pixels		Read or modify symbol-library properties
		B6	Current date and time		Create a new symbol
					Delete a symbol

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SFT2841 Software Mimic-Diagram Editor
Use

Use

You can use the mimic-diagram editor on three different levels, depending on how much the diagram is personalized:

- normal use, to adapt a predefined diagram
- advanced use, such as completing a predefined diagram
- expert use, like creating a new diagram

Normal Use

Use the normal level first because of its simplicity.
To adapt a predefined diagram, follow these steps:

1. Select a predefined diagram template in the IEC or ANSI libraries.
2. Set up the diagram properties.
3. Finish the diagram.
4. Assign the symbol inputs and outputs, if necessary.
5. Save the diagram.
6. Quit the mimic-diagram editor.

Advanced Use

To complete a predefined diagram, proceed as follows:

1. Select a predefined diagram template in the IEC or ANSI libraries.
2. Add an existing symbol or measurement to the diagram.
3. Set up the diagram properties:
   - finish the diagram
   - select the new measurements to be displayed
   - assign the symbol inputs and outputs, if necessary
4. Save the diagram.
5. Quit the mimic-diagram editor.

Expert Use

Creating a completely new diagram requires the user to know about all the functions offered by the mimic-diagram editor. To create a new diagram, proceed as follows:

1. Create new symbols in the symbol library.
2. Set up the properties of the new symbols.
3. If applicable, create new diagram templates on the main window.
4. Create the new diagram:
   - add the symbols
   - add the measurements
   - draw the background of the diagram
5. Set up the diagram properties:
   - select the new measurements to be displayed
   - assign the symbol inputs and outputs, if necessary
6. Save the diagram.
7. Quit the mimic-diagram editor.

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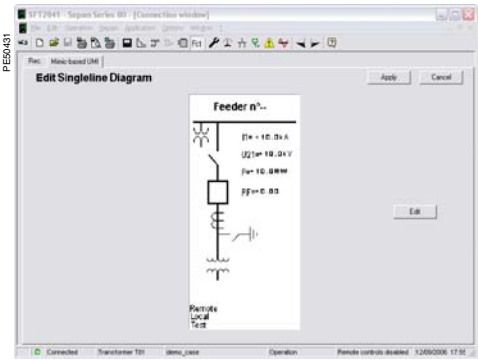
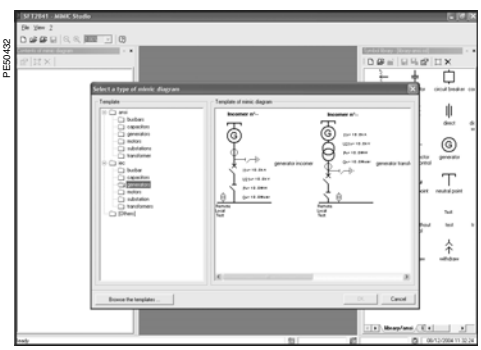
SFT2841 Software Mimic-Diagram Editor
Use



Access to the mimic-diagram editor



Selection of a predefined diagram template

Running the Mimic-Diagram Editor

The mimic-diagram editor can be accessed only if the Sepam™ Series 80 was set up with a mimic-based UMI on the "Hardware set-up" screen in the SFT2841 software.

To access the mimic-diagram editor:

1 Press Fct
2 Select the "Mimic-based UMI" tab.
3 Click the **Edit** button to run the mimic-diagram editor.
4 Close or reduce the mimic-diagram editor to return to the setting and operating screens in the SFT2841 software.

When you run the mimic-diagram editor:

- if a diagram is already linked to the Sepam™, the editor displays the diagram
- if a diagram is not linked to the Sepam™, a window opens for selection of a predefined diagram template in one of the two diagram libraries supplied:
  - diagrams complying with standard IEC 60617
  - diagrams complying with standard ANSI Y32.2-1975

Selecting Predefined Diagram Templates

The window used to select a predefined diagram template is displayed:

- when you open the mimic-diagram editor for the first time
- when you select the File/New command
- when you select

SFT2841 supplies two libraries of predefined diagrams:

- diagrams complying with standard IEC 60617
- diagrams complying with standard ANSI Y32.2-1975.

For each Sepam™ application, each library contains a number of predefined diagram templates corresponding to the most frequently encountered single-line diagrams. You can manage other diagram templates by clicking the [Browse the templates] button.

To see the available diagrams, select a subcategory (like *Substations*). A number of diagrams will display in the "Template of mimic diagram" window.

To select a diagram template, select the drawing and then click **OK** to confirm.

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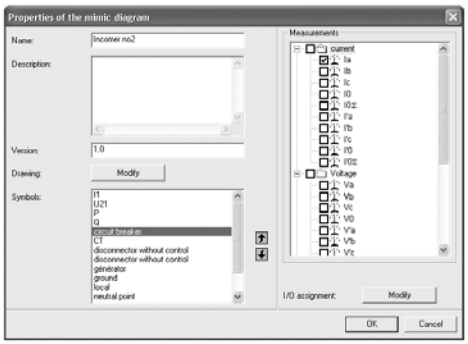
SFT2841 Software Mimic-Diagram Editor
Use



Personalization of diagram properties

Diagram Properties Setup

You can completely personalize the operation of a mimic-diagram.

This icon in the diagram explorer toolbar provides access to the **Properties of the mimic diagram** window.

Four operations comprise personalizing diagram properties:

1 Indicating general diagram properties: diagram name, description and version.
2 Diagram modifications.
3 Checking the measurements displayed in the predefined fields against the list of values measured by Sepam™.
4 Assigning inputs/outputs to the animated/controlled symbols making up the diagram.

Diagram Modifications

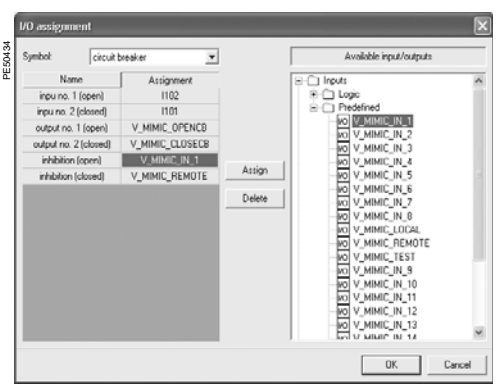
Click the **Modify** button to run the drawing software on the PC (MS Paint by default). The background will display without the symbols or the fields reserved for the measurements.

Use the drawing software to rework the diagram, add text or modify the title.

Checking Diagram Measurements

Each **Measurement** symbol in the diagram links by default to the corresponding Sepam™ measurement. For example, the **Ia** symbol links to the value of current Ia, the phase **"a"** current measured by Sepam™.

You can display additional measurement values to select in the **Measurements** list.



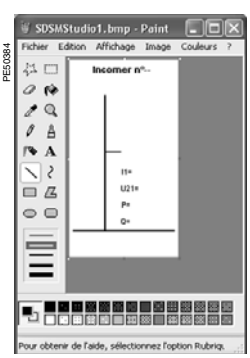
Logic input/output assignment

Logic Input/Output Assignment

The **Modify** button for input/output assignment opens the **I/O assignment** window. In this window you can check and modify the Sepam™ variables assigned to each input and output of each symbol.

Follow these steps to modify the symbol inputs and outputs in a mimic-diagram:

1 Select a symbol.
2 Select an input to be modified, if applicable.
3 Select the desired Sepam™ input variable among the available inputs (it is not possible to assign a Sepam™ output variable to a symbol input)
4 Click the **Assign** button to link the Sepam™ variable to the symbol input
5 Click the **Delete** button to release the symbol input.
6 Proceed in the same manner to modify the assignment of a symbol output, if applicable.
7 Confirm the modifications by clicking **OK**.
8 Select the next symbol and proceed in the same manner.



Drawing of the background of the diagram

Diagram Background Modification

The background is a drawing without the symbols or the fields reserved for the measurements. You can modify the background using the drawing software on the PC (Microsoft Paint is the default drawing software):

- to add text or modify the title of the diagram
- to add descriptions for new measurements
- to complete the single-line diagram and add new symbols to the diagram

You can run drawing software:

- through the **Diagram properties** window
- by double-clicking the diagram on the main editor window

Save the new drawing and quit the drawing software before you return to the mimic-diagram editor.

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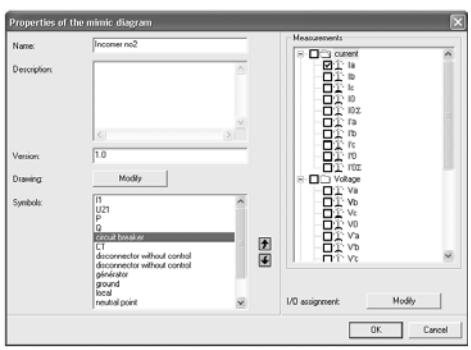
SFT2841 Software Mimic-Diagram Editor
Use



Personalization of diagram properties

Adding Existing Symbols to the Diagram

Follow these steps to add an existing symbol to a diagram:

1 Select an existing symbol in one of the symbol libraries.
2 Add the symbol to those already in the diagram by clicking in the diagram explorer. The new symbol displays in the upper left-hand corner of the diagram.
3 Modify the drawing by adding the graphic elements required to connect the new symbol in the mimic-diagram.
4 Correctly position the new symbol in the diagram:
5 Select the new symbol with a click on the left mouse button
6 Hold and drag the symbol to the desired position in the diagram.

Use these steps to precisely position the symbol to indicate the desired coordinates:

1 open the **Symbol properties** window
2 Modify the symbol coordinates (X, Y) in the **Specific** zone
3 Click **OK** to confirm the new position.

To test the animation of the new symbol:

1 Open the **Symbol properties** window
2 Modify symbol state: modify the data in the "**VALUE**" field in the "Specific" zone
3 Click **OK** to confirm the new state. This will also check the new graphic representation of the symbol in the diagram.

Adding Measurements to a Diagram

The following measurements can be shown on a diagram:

- current: Ia, Ib, Ic, I'a, I'b, I'c, Ir, IrΣ, I'r, I'rΣ
- voltage: Van, Vbn, Vcn, Vr, Vab, Vbc, Vac, V'an, V'bn, V'cn, V'r, V'ab, V'bc, V'ac
- power: P, Q, S, pf.

Perform the following steps to add a measurement to a diagram:

1 Display diagram properties by clicking in the diagram explorer.
2 In the "Measurements" list, click the box for the measurement to add
3 Click on **OK** to confirm.
4 The new measurement displays in the upper left-hand corner of the diagram.
5 Modify the drawing by adding a description of the new measurement, like, "Ir =".
6 Correctly position the new measurement in the diagram:
7 Select the new measurement by clicking on the left mouse button
8 Hold and drag the measurement to the desired position in the diagram.

Use these steps to precisely position the symbol to indicate the desired coordinates

1 Open the **Symbol properties** window.
2 Modify the measurement coordinates (X, Y) in the "Specific" zone.
3 Click **OK** to confirm the new position.
4 Modify the display size of the new measurement:
5 Open the **Symbol properties** window
6 Modify the display size of the measurement by changing the value in the **Size** field in the **Specific** zone
7 Click **OK** to confirm the new size, This will also check the new graphic representation of the measurement in the diagram.

Deleting Diagram Symbols or Measurements

Use these steps to delete a symbol or measurement in the diagram:

1 Select the symbol or measurement to be deleted in the diagram explorer.
2 Click in the diagram explorer to delete the symbol or measurement .

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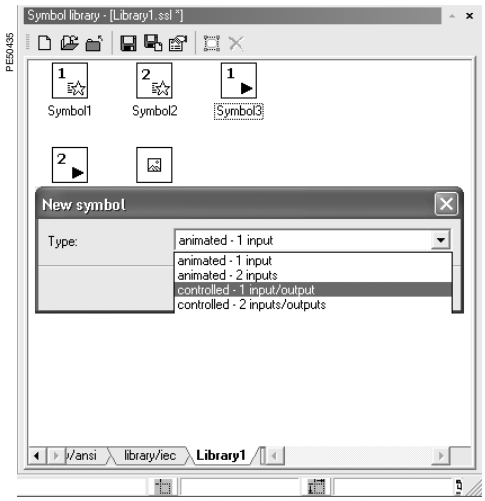
SFT2841 Software Mimic-Diagram Editor
Use



Creating new symbols

Creating New Symbols

Two libraries of predefined diagrams are supplied in the "Symbol library" window:

- a set of diagrams complying with the IEC standard
- a set of diagrams complying with the ANSI standard.

It is not possible to create new symbols in the two libraries. Each symbol is represented by an icon.

Proceed as follows to create a new symbol:

1. Click to create a new library or select a previously created library.
2. Create a symbol in the library by clicking .
3. Select the type of symbol in the **New symbol** window among the five types of symbols available. The five types are presented in the section below. The symbol is displayed in the library with a default icon.
4. Double-click the symbol to set up the symbol properties. The **Symbol Properties** window appears to personalize the graphic representation of the symbol and assign the inputs and outputs.

   See the section on **Definition of symbol properties** for more information.

Types of Symbols

Symbol Type	Default Icon	Inputs	Symbol Example	Outputs
Animated - 1 input		Active		
Animated - 2 inputs		Open Closed		
Controlled - 1 input/output		Active Inhibition (active) Inhibition (inactive)		Active
Controlled - 2 inputs/outputs		Open Closed Inhibition (open) Inhibition (closed)		Open Close
Fixed				

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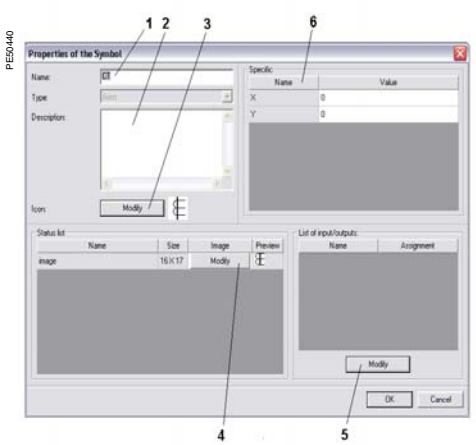
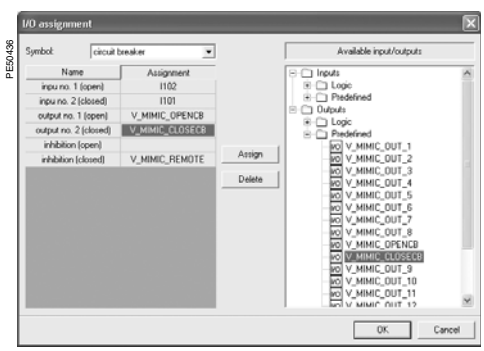
SFT2841 Software Mimic-Diagram Editor
Use



Definition of symbol properties:
1 *Symbol name*
2 *Symbol description*
3 *Modify the icon*
4 *Modify the graphic representations of symbol states*
5 *Modify input/output assignments*
6 *Position and test the symbol in the diagram*



Input/output assignment

Setting Up Symbol Properties

You can personalize symbol properties in the "Symbol properties" window.

Four events comprise personalizing symbol properties:
1 Indicating the general symbol properties: name and description.
2 Modificating the symbol icon.
3 Modifying the graphic representations of symbol states.
4 Assigning the inputs/outputs linked to the symbol.

Modifying the Symbol Icon

The icon represents the symbol in the library of symbols.
1 Click the **Modify** button **(3)** to run the drawing software.
2 Modify the displayed icon as desired as long as the format (32 x 32 pixels) is maintained.
3 Save the new icon and quit the drawing software before going on to the next step.

Modifying the Graphic Representations of Symbol States

The animated or controlled symbols are represented in the diagram in two or three different states. A graphic representation corresponds to each state.

1 Click the **Modify** button **(4)** to run the drawing software.
2 Modify the symbol graphic as necessary.
3 **Save** the new representation
4 **Quit** the drawing software before going on to the next step.

Assigning Inputs and Outputs Linked to a Symbol.

The **Modify** button **(5)** opens the **I/O assignment** window used to assign a Sepam™ variable to each input and output of the symbol.

Proceed as follows to assign a symbol input:
1 Select a symbol input.
2 Select a Sepam™ input variable among the available inputs (it is not possible to assign a Sepam™ output variable to a symbol input).
3 Click the **Assign** button to link the Sepam™ variable to the symbol input.

Use these same steps to assign a symbol output.

Creating Predefined Diagram Templates

You can save a personalized mimic-diagram as a template for later use. It is similar to the predefined diagram templates in the IEC and ANSI diagram libraries.

Use the following steps to save a personalized diagram as a diagram template:
1 Select the **File / Save As…** command.
2 Open the directory \SDSMStudio\Template.
3 If necessary, create a personalized directory in addition to the existing \IEC and \ANSI directories.
4 Enter the name of the diagram file with the .sst extension.
5 Set the type of file as "**Document template** (*.sst)".
6 Save the mimic diagram.

When the mimic-diagram editor runs, the new predefined diagram templates are shown in the personalized directory or in the "Others" directory.

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⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Obey all existing safety instructions when commissioning and maintaining high-voltage equipment.
- Beware of potential hazards and wear personal protective equipment.

Failure to follow these instructions will result in death or serious injury.

Protection Relay Testing

Protection relays are tested prior to commissioning. The twofold goal of these tests is to maximize availability and minimize the risk of commissioning a malfunctioning assembly. Since the relay under test is always the main link in the protection chain, defining the consistency of the appropriate tests is an ongoing challenge.

Since performance is not perfectly reproducable, protection relays based on electromechanical and static technologies are systematically submitted to detailed testing for three reasons:

- to qualify relay commissioning
- to check that they actually are in good operating order
- to maintain the required level of performance

The Sepam™ concept makes it possible to do away with such testing, since the use of digital technology guarantees the reproducibility of the performances announced.

Each Sepam™ function undergoes full factory qualification. An internal self-testing system provides continuous information on the state of the electronic components and the integrity of the functions.

For example, automatic tests diagnose the level of component polarization voltages, the continuity of the analog value acquisition chain, non-alteration of RAM memory, and any absence of settings outside the tolerance range. This guarantees a high level of availability

Sepam™ is ready to operate without requiring any additional qualification testing that concerns it directly.

Sepam™ Commissioning Tests

Preliminary Sepam™ commissioning tests involve checks, such as:

- checking for compliance with Bills of Material (BOMs), hardware installation diagrams, and rules during a preliminary general check
- checking for compliance with the general settings and protection settings entered with the setting sheets
- checking current or voltage input connections by secondary injection tests
- checking logic input and output connections by simulation of input data and forcing of output status
- validating the complete protection chain (possible customized logical functions included)
- checking the connection of the optional MET148-2, MSA141 and MSC025 modules

The various checks are described on the next page.

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General Principles

1 **Conduct all tests with the MV cubicle completely isolated and the MV circuit breaker racked out (disconnected and open)**
2 **Perform all tests in the operating situation: no wiring or setting changes, even temporary changes to facilitate testing, are allowed.**

The SFT2841 parameter setting and operating software is the basic tool for Sepam™ users. It is especially useful during Sepam™ commissioning tests. The tests described in this document are based on the systematic use of this tool. You can perform the commissioning tests without the SFT2841 software for Sepam™ units with advanced UMIs.

For each Sepam™:
- only carry out the checks suited to the hardware configuration and the functions activated
- use the test sheet provided to record the results of the commissioning tests

A comprehensive description of all the tests is given later.

Checking Current and Voltage Input Connections

Factors affecting secondary injection tests include, but are not limited to:
- the type of current and voltage sensors connected to Sepam™ for residual current and voltage measurement
- the type of injection generator used for the tests: three-phase or single-phase generator
- the type of Sepam™

These tests check the current and voltage input connections. The descriptions below also include:
- a detailed test procedure
- the connection diagram of the associated test generator

Determining Checks to Conduct

The table below indicates the page on which the following are described:
- general tests performed according to the type of measurement sensors and type of generator used
- additional tests performed for certain types of Sepam™ having a single or three-phase generator

General Tests

Current Sensors	Voltage Sensors	Three-Phase Generator	Single-Phase Generator
3 CTs or 3 LPCTs	3 VTs	page 122	page 124
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	3 VTs	page 122 page 129	page 124 page 129
3 CTs or 3 LPCTs	3 VTs 3 V0 VTs	page 122 page 130	page 124 page 130
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	3 VTs 3 Vr VTs	page 122 page 128	page 124 page 128
3 CTs or 3 LPCTs	2 phase VTs 3 Vr VTs	page 123 page 130	page 125 page 130
3 CTs or 3 LPCTs 1 or 2 zero sequencezero sequence CTs	2 phase VTs 3 Vr VTs	page 123 page 128	page 125 page 128
3 CTs or 3 LPCTs	3 VTs 1 neutral point VT	page 122 page 131	page 124 page 131
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	3 VTs 1 neutral point VT	page 122 pages 129 and 131	page 124 pages 129 and 131
3 CTs or 3 LPCTs	2 phase VTs 1 neutral point VT	page 123 page 131	page 125 page 131
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	2 phase VTs 1 neutral point VT	page 123 pages 129 and 131	page 125 pages 129 and 131

Additional Tests

Type of Sepam™	Type of Test	
T87, M87, M88, G87, G88	Phase current input connections for differential application	page 126
B80	Additional phase voltage input connection	page 132
B83	Additional phase voltage input connections	page 134
B83	Additional residual voltage input connection	page 134
C86	Unbalance current input connections	page 137

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Required Testing and Metering Equipment

Generators

The AC and DC Generators have the following characteristics:

- dual sinusoidal AC current and voltage generator:
  - 50 or 60 Hz frequency (according to the country)
  - current adjustable up to at least 5 A rms
  - adjustable up to the rated secondary phase-to-phase voltage of the VTs
  - adjustable relative phase displacement (V, I)
  - three-phase or single-phase type
- DC voltage generator:
  - adjustable from 48 to 250 V DC, for adaptation to the voltage level of the logic input being tested

Accessories

The following accessories come with the metering and testing equipment:

- plug with cord to match the "current" test terminal box installed
- plug with cord to match the "voltage" test terminal box installed
- electric cord with clamps, wire grip or touch probes

Metering Devices (part of the generator or separate)

- 1 ammeter, 0 to 5 A rms
- 1 voltmeter, 0 to 230 V rms
- 1 phasemeter, if phase displacement (V, I) is not identified on the voltage and current generator

Computer Equipment

- PC with minimal configuration:
  - Microsoft Windows 98 / NT4.0 / 2000 / XP
  - 133 MHz Pentium processor
  - 64 MB of RAM (32 MB with Windows 98)
  - 64 MB free on hard disk
  - CD-ROM drive
  - One serieal port (or USB port with serial converter)
- SFT2841 software
- CCA783 serial connection cord between the PC and Sepam™

Documents

- complete connection diagram of Sepam™ and additional modules, with:
  - phase current input connections to the corresponding CTs via the test terminal box
  - residual current input connection
  - phase voltage input connections to the corresponding VTs via the test terminal box
  - residual voltage input connection to the corresponding VTs via the test terminal box
  - logic input and output connections
  - temperature sensor connections
  - analog output connection
  - connection of the sync-check module
- hardware bill-of-materials (BOMs) and installation rules
- group of Sepam™ parameter and protection settings, available in paper format (or setting files made with SFT2841 software)

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General Examination and Preliminary Actions

Checks Performed Prior to Energizing

Check the following for correct status:

- identification of Sepam™ and accessories determined by the contractor
- proper grounding of Sepam™ through terminal 13 of the 20-pin connector (E) (see page 20) and the functional grounding terminal located on the back of the Sepam™ unit
- auxiliary voltage properly connected
  - terminal 1: positive polarity
  - terminal 2: negative polarity
- presence of the detection of plugged connectors (DPC) bridge on terminals 19-20 of the 20-pin connector (E)
- presence of a residual current measurement zero sequence CT and/or additional modules connected to Sepam™ when applicable
- presence of test terminal boxes upstream from the current inputs and voltage inputs
- conformity of connections between Sepam™ terminals and the test terminal boxes

You can use the supplied diagrams and Bills of Material (BOMs) as additional sources to verify the information.

Connections

Before you apply power to the equipment:

- ensure the connections are tightened to 6.2 to 8.8 in/lb
- the Sepam™ connectors are correctly plugged in and locked

Energizing

Turn on the auxiliary power supply and monitor Sepam's initialization sequence:

- green ON and red indicators ON
- red indicator OFF
- "watchdog" contact pick-up
- the first screen displayed is the phase current measurement screen

This initialization sequence lasts approximately six seconds.

Implementing the SFT2841 Software

1. Turn on the PC and use local login procedures as necessary.
2. Connect the PC RS232 serial port to the communication port on the front panel of Sepam™ using the CCA783 cord.
3. Start the SFT2841 software by clicking on the related icon.
4. Connect to the Sepam™ you want to check.

Identifying Sepam™ Components

Enter the following items on the test sheet:

- the Sepam™ serial number found on the label on the right side plate of the base unit
- the references that define the type of application indicated on the adhesive label on the Sepam™ cartridge
- the Sepam™ type and software version using the SFT2841 software, **Sepam™ Diagnosis** screen

Determining Parameter and Protection Settings

The design department in charge of the application determines all Sepam™ parameter and protection settings . These settings are approved by the customer.

It is presumed the installation protection system study has been carried out with all due diligence, and/or consolidated by a network coordination study.

All Sepam™ parameter and protection settings should be available at the time of commissioning:

- in paper file format (with the SFT2841 software, the parameter and protection settings file for a Sepam™ may be printed directly)
- and, when applicable, in the format of a file to be downloaded into Sepam™ using the SFT2841 software

Settings Check

There may be an occasion when Sepam™ parameter and protection settings have not been entered or downloaded during commissioning testing. Perform the following steps to validate the settings entered are those determined during the installation protection system study:

1. Go through all the parameter and protection setting screens in the SFT2841 software, in the order proposed in guided mode.
2. For each screen, compare the values entered in the Sepam™ with the values recorded in the parameter and protection setting file.
3. Correct any parameter and protection settings that have not been entered correctly, proceeding as indicated in the SFT2841 section of the Use chapter of this manual.

Note: *This check does not confirm the relevance of the parameter and protection settings.*

Conclusion

Once the checks are complete and conclusive for that phase, the parameter and protection settings are considered final and should not be changed any further.

To be conclusive, you must perform the following tests with these parameter and protection settings. Temporary modifications of any values to facilitate a test is not allowed.

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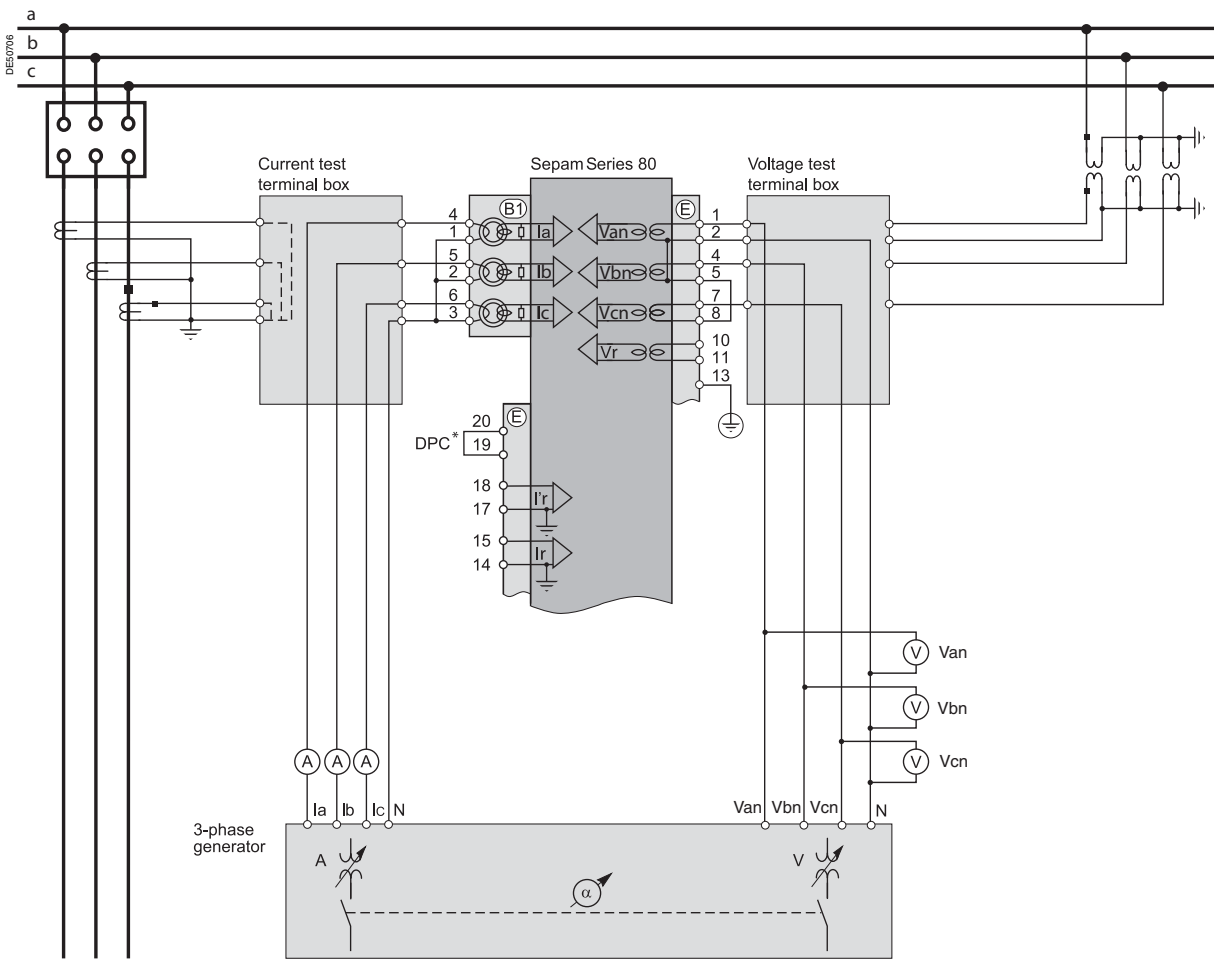
Checking Input Connections
3-Phase Generator

Block Diagram: 3 VTs Connected to Sepam™



** Detection of Plugged Connector (required for proper operation. Installed manually)*

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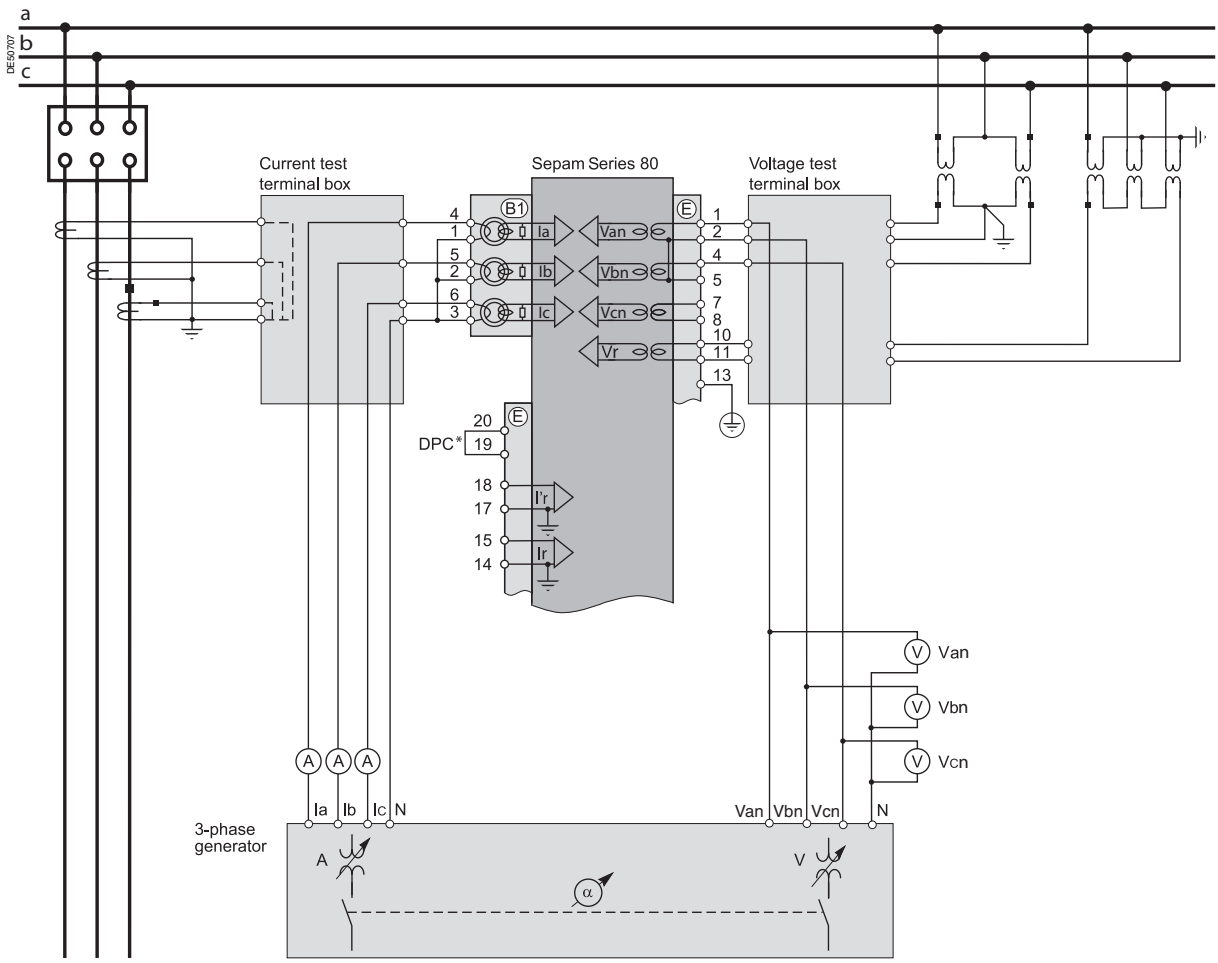
Checking Input Connections
3-Phase Generator

Block Diagram: Two VTs Connected to Sepam™



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

Perform the following steps to check input connections when two or three VTs are connected to Sepam™, as shown in the preceding two diagrams:

1. Connect the 3-phase voltage and current generator to the corresponding test terminal boxes. Use the plugs provided, according to the appropriate diagram in terms of the number of VTs connected to Sepam™.
2. Turn the generator on.
3. Apply the three generator voltages Van, Vbn and Vcn, balanced and set to the rated secondary phase-to-neutral voltage of the VTs (that is, $V_{NS} = V_{LL}s/\sqrt{3}$).
4. Inject the three generator currents Ia, Ib and Ic, balanced and set to the rated secondary current of the CTs (namely, 1A or 5A) and in phase with the voltages applied (specifically, generator phase displacement:

   $$\alpha 1(Van, Ia) = \alpha 2(Vbn, Ib) = \alpha 3(Vcn, Ic) = 0°).$$

5. Use the SFT2841 software to check the following:
   - the value indicated for each of the phase currents Ia, Ib, and Ic is approximately equal to the rated primary current of the CTs
   - the value indicated for each of the phase-to-neutral voltages Van, Vbn, and Vcn is approximately equal to the rated primary phase-to-neutral voltage of the VT

     $$(V_{Ln}p = V_{LL}p/\sqrt{3})$$

   - the value indicated for each phase displacement φa(Van, Ia), φb(Vbn, Ib), and φc(Vcn, Ic) between currents Ia, Ib or Ic and voltages Van, Vbn,or Vcn respectively is approximately equal to 0°
6. Turn the generator off.

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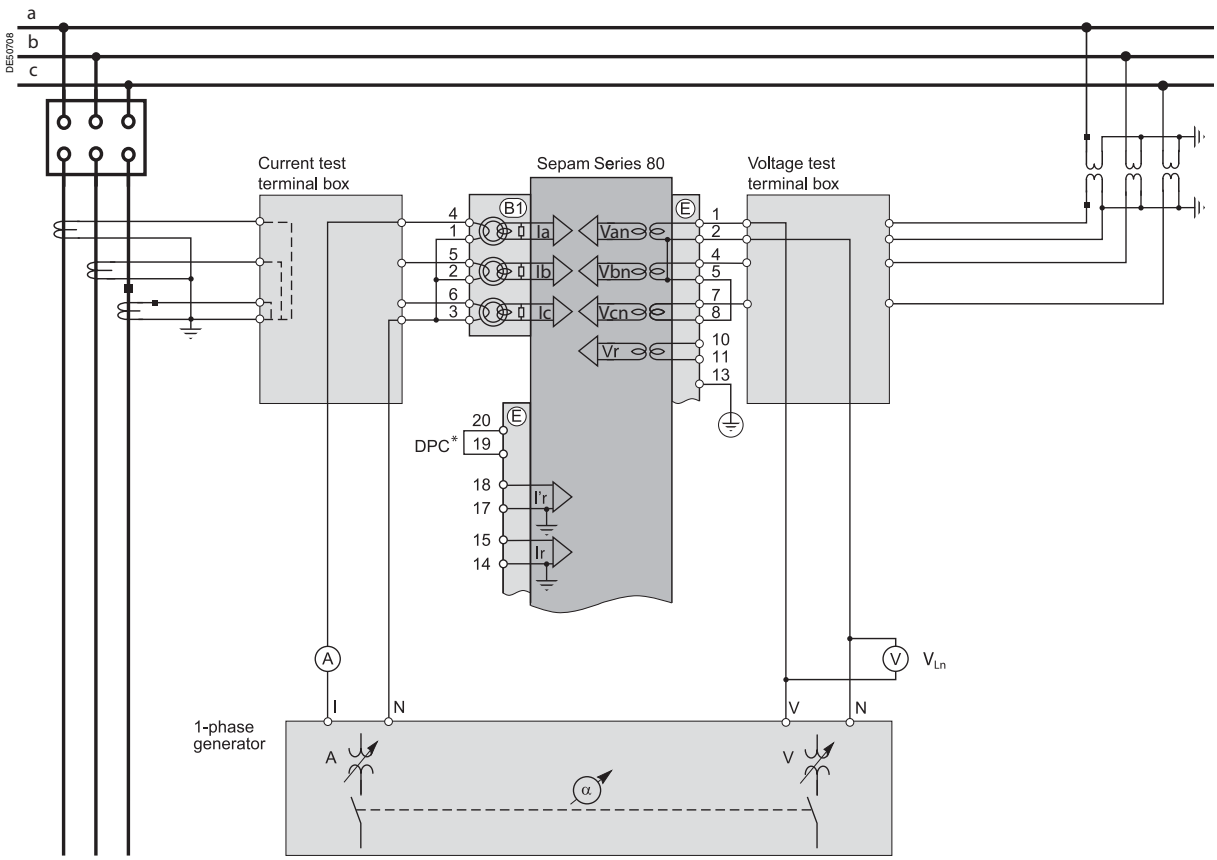
Checking Input Connections
Single-Phase Generator & Voltages Delivered by 3 VT

Block Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

1. Connect the single-phase voltage and current generator to the corresponding test terminal boxes, using the plugs provided, according to the block diagram above.
2. Turn the generator on.
3. Apply the generator V-N voltage set to the rated secondary phase-to-neutral voltage of the VTs (that is, $V_{Ln}s = V_{LLs}/\sqrt{3}$) between Sepam's phase a voltage input terminals (via the test box).
4. Inject the generator I current, set to the rated secondary current of the CTs (namely, 1A or 5A) and in phase with the V-N voltage applied (specifically,generator phase displacement $\alpha(V_{Ln}, I) = 0°$) to Sepam's phase a current input (via the text box).
5. Use the SFT2841 software to check the following:
   - the value indicated for Ia phase current is approximately equal to the rated primary current of the CT
   - the value indicated for Va phase-to-neutral voltage is approximately equal to the rated primary phase-to-neutral voltage of the VT ($V_{Ln}p = V_{LL}p / \sqrt{3}$)
   - the value indicated for the phase displacement φa(Van, Ia) between the Ia current and Van voltage is approximately equal to 0°
6. Proceed in the same way by circular permutation with the phase b and c voltages and currents, to check the Ib, Vbn, φb(Vbn, Ib) and Ic, Vcn, φc(Vcn, Ic) values
7. Turn the generator off.

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Checking Input Connections
Single-Phase Generator & Voltages Delivered by 2 VT

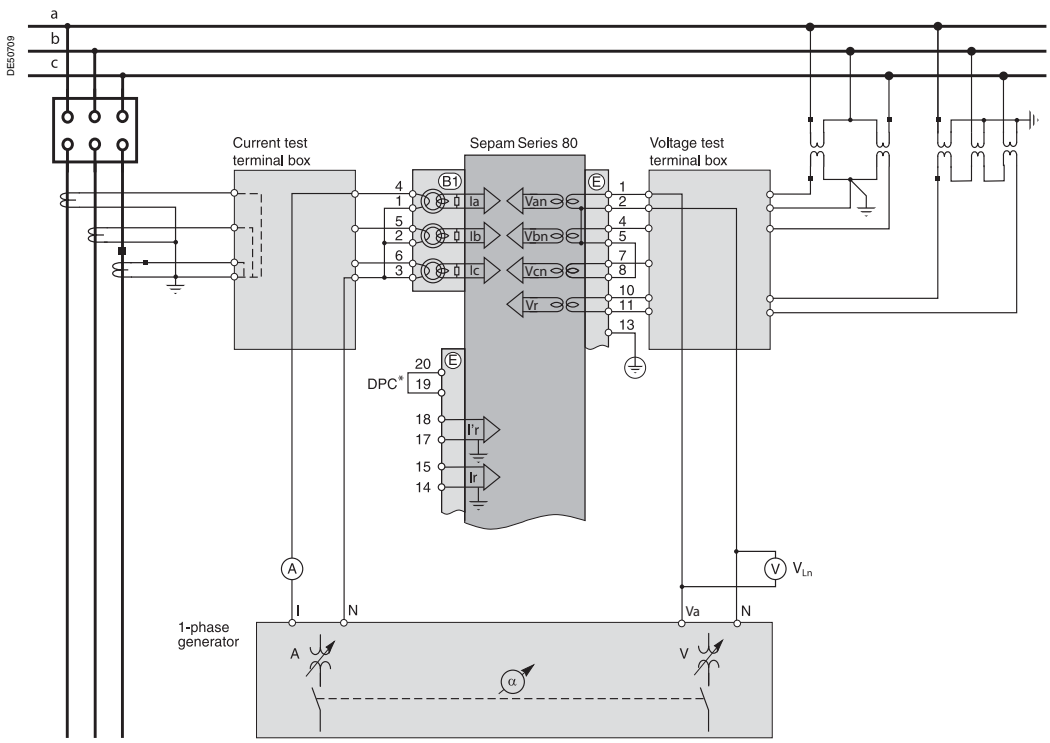
Description

Perform this check when:
- the input foltages are supplied by two VTs as a set
- the VTs connect phase-to-phase in the primary

With this configuration, the residual voltage must be obtained outside Sepam™ by using three VTs that have their secondaries connected in a broken delta arrangement.

You can also perform this check when the residual voltages are either:
- obtained by other means
- used for purposes other than protection (control, monitoring, alarm)

Block Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

1. Connect the single-phase voltage and current generator to the corresponding test terminal boxes by using the plugs provided, according to the block diagram.
2. Turn the generator on.
3. Apply (via the test box) the voltage delivered at the V-N terminals of the generator, set to $\sqrt{3}/2$ multiplied by the rated secondary phase-to-phase voltage of the VTs (that is, $\sqrt{3}\ V_{LL}s / 2$) between terminals 1-2 of Sepam's voltage inputs.
4. Inject the generator I current, set to the rated secondary current of the CTs (that is, 1A or 5A) and in phase with the V_{Ln} voltage applied (specifically, generator phase displacement α(V-N, I) = 0°) to Sepam's phase a current input (via the test box).
5. Use the SFT2841 software to check the following:
   - the value indicated for Ia phase current is approximately equal to the rated primary current of the CT (INp).
   - the value indicated for Van phase-to-neutral voltage is approximately equal to the rated primary phase-to-neutral voltage of the VT ($V_{Ln}p = V_{LL}p / \sqrt{3}$)
   - the value indicated for the phase displacement φ1(V1, I1) between the Ia current and Va voltage is approximately equal to 0°
6. Proceed in the same way to check the Ib, Vb, φb(Vb, Ib) values:
   - apply the generator V_{Ln} voltage set to $\sqrt{3}\ V_{LL}s / 2$ in parallel between terminals 1-2 and 4-2 of Sepam's voltage inputs (via the test box).
   - inject a current set to 1A or 5A and in phase opposition with the V_{Ln} voltage (that is, $\alpha(V_{Ln}, I) = 180°$) to Sepam's phase b current input (via the test box)
   - obtain Ib ≅ INp, Vbn ≅ $V_{Ln}p = V_{LL}p/\sqrt{3}$ and φb ≅ 0°. In the absence of residual voltage, Vbn = 0, Vab = $\sqrt{3}\ V_{LL}p / 2$
7. Check the Ic, Vcn, φc(Vcn, Ic) values as well:
   - apply the generator V_{Ln} voltage set to $\sqrt{3}\ V_{LL}s / 2$ between terminals 4 and 2 of Sepam's voltage inputs (via the test box)
   - inject a current equal to 1A or 5A and in phase with the V_{Ln} voltage (namely, $\alpha(V_{Ln}, I) = 0°$) to Sepam's phase c current input (via the test box)
   - obtain Ic ≅ INp, Vcn ≅ $V_{Ln}Lp = V_{LL}p / \sqrt{3}$ and φc ≅ 0°. In the absence of residual voltage, Vcn = 0, Vab = $\sqrt{3}\ V_{LL}p / 2$
8. Turn the generator off.

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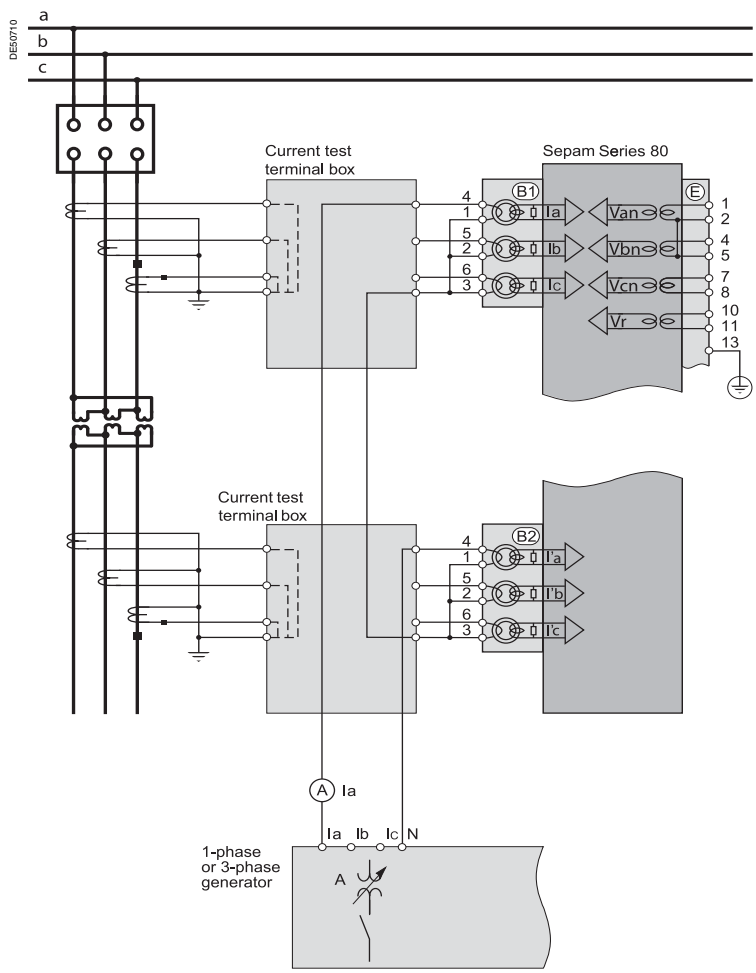
Checking Phase Current Input Connections
For Differential Applications

Description

Perform this check to test differential applications (machine, transformer or transformer-machine unit). This test is carried out along with checking phase current and phase voltage input wiring. The purpose is to check the wiring of the second Sepam™ current input.

Block Diagram



DE50359

If the secondary circuits of the CTs do not have the same ratings (1 and 5A or 5 and 1A) as the Sepam™ current inputs they are connected to, set the injection value to the lowest secondary rating. The value indicated for the phase currents (Ia, Ib, Ic) or (I'a, I'b, I'c), is then equal to the CT rated primary current divided by 5 (I_N/5).

Procedure

1. Connect the generator current terminals to the corresponding current test terminal boxes according to the block diagram. Use the plugs provided.
2. Turn the generator on.
3. Adjust the generator current output, **I**, to match the CT rated secondary current (1A or 5A).
4. Inject the generator output (as shown) into the phase 1 current input terminals of each Sepam™ connector (B1), and (B2), connected in opposition (via the test boxes, according to the diagram above).
5. Use the SFT2841 software to check the following:
   - the value indicated for phase current Ia is approximately equal to the rated primary current of the CT (In) wired to the Sepam™ (B1) connector
   - the value indicated for phase current I'a is approximately equal to the rated primary current of the CT (I'n) wired to the Sepam™ (B2) connector
   - the value indicated for phase displacement θ(I, I') between currents Ia and I'a is equal to 0°
6. Check the Ib and I'b, Ic and I'c, and θ(I, I') values as well the values between Ib-I'b and Ic-I'c after transferring the injection plugs to the phase b current and then phase c current input terminals of each of the Sepam™ connectors.
7. Turn the generator off.

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Checking Phase Current Input Connections
LPCT Type Current Sensors

Measuring Phase Current by LPCT Sensors

The three LPCT current sensors connect through an RJ45 plug to the CCA671 connector that mounts on the rear panel of Sepam™, identified as (B1) and/or (B2). see page 20 of this manualfor more information.

Sepam™ enters a fail-safe condition when less than three LPCT sensors are connected. Such a configuration is not allowed.

Enter the rated primary current *In* measured by the LPCT sensors as a Sepam™ general setting and configure by microswitches on the CCA671 connector.

Restrictions on the use of LPCT type current sensors

LPCT type current sensors may not be used for the following measurements:

- phase current measurements for Sepam™ T87, M88 and G88 units with ANSI 87T transformer differential protection ((B1) and (B2) connectors)
- phase current measurement for Sepam™ B83 ((B1) connector)
- unbalance current measurement for Sepam™ C86 ((B2) connector)

Procedure

The tests that check phase current input connections are the same whether the phase currents are measured by CTs or LPCT sensors. Only the Sepam™ current input connection procedure and current injection values change.

The ACE917 injection adapter is required to test current inputs connected to LPCT sensors with a standard injection box. The ACE917 adapter is inserted between:

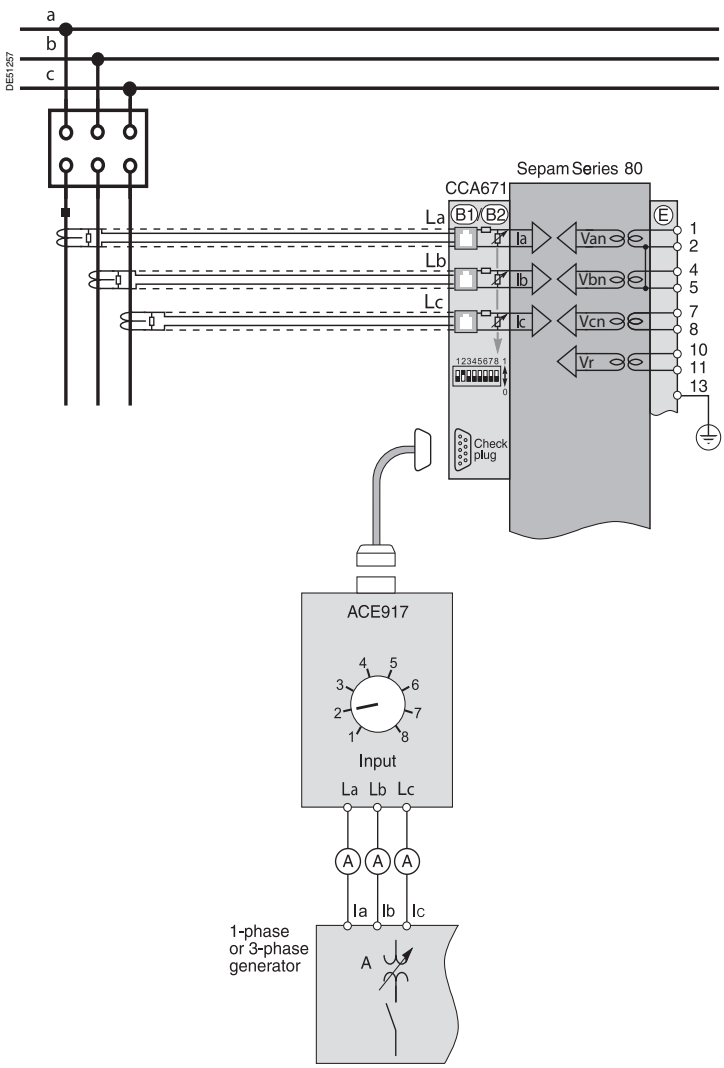
- the standard injection box
- the LPCT test plug
  - integrated in the Sepam™ CCA671 connector
  - or transferred by means of the CCA613 accessory

Set the ACE917 injection adapter according to the currents selected on the CCA671 connector. The ACE917 setting should be equal to the number of the microswitch that is set to 1 on the CCA671.

The injection value depends on the rated primary current selected on the CCA671 connector and entered in the Sepam™ general settings:

- 1A for the following values (in Amps): 25, 50, 100, 133, 200, 320, 400, 630
- 5A for the following values (in Amps): 125, 250, 500, 666, 1000, 1600, 2000, 3150.

Block Diagram (without CCA613 Accessory)



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Checking Residual Current/ Voltage Input Connections

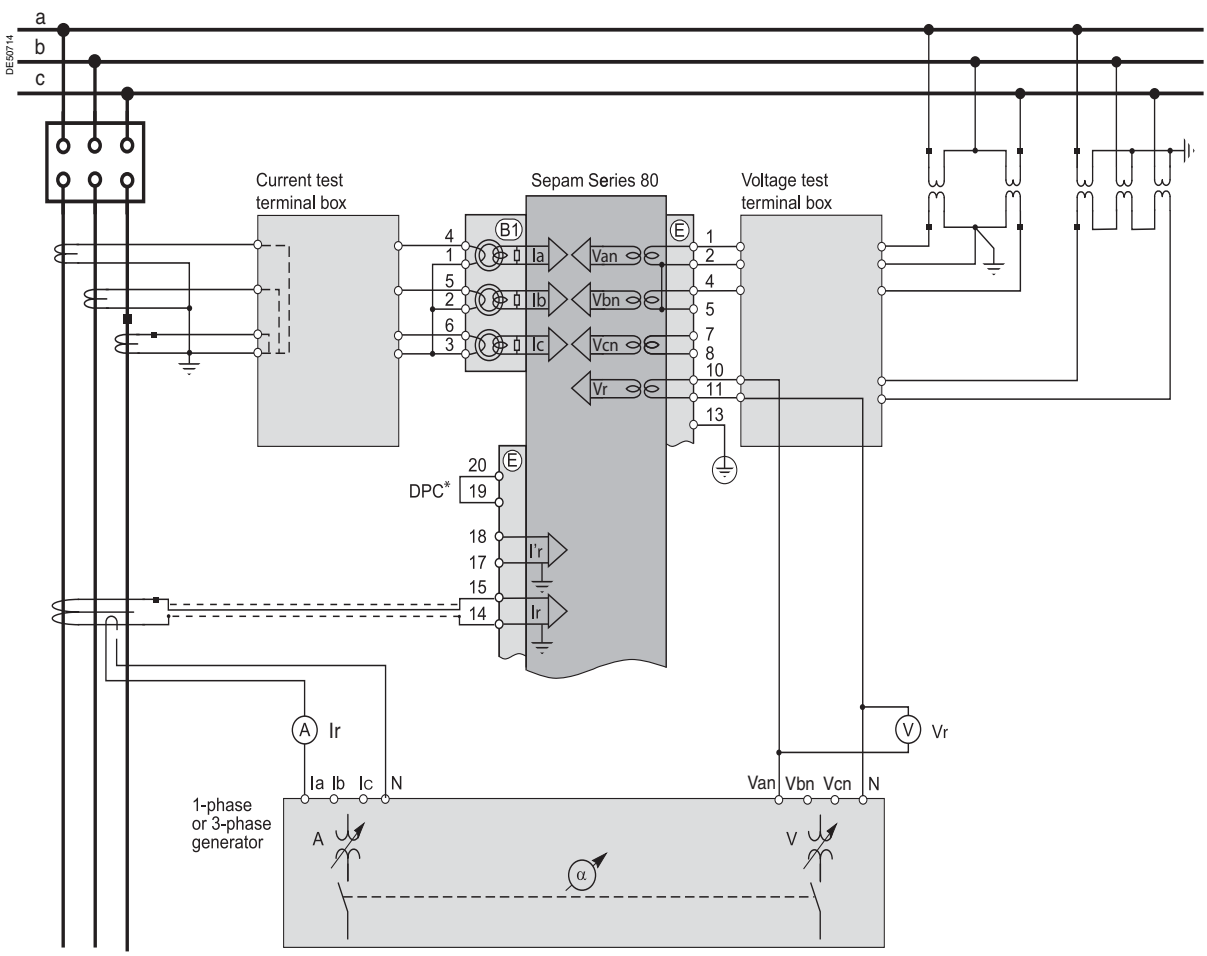
Description

Perform this check when the residual voltage is:

1 delivered by three VTs on the secondary circuits connected in a broken delta arrangement

2 when the residual current is obtained by a specific sensor such as:
- CSH120 or CSH200 zero sequence CT
- CSH30 interposing ring CT (whether installed on the secondary circuit of a single 1A or 5A CT that encompasses the three phases, or on the neutral connection of the three 1A or 5A phase CTs)
- other zero sequence CT connected to an ACE990 interface

Block Diagram



Note: *the number of CTs/VTs connected to the Sepam™ current/voltage connector phase inputs is given as an example and is not used for the test.*

** Detection of Plugged Connector (required for proper operation. Installed manually)*

DE51359

Sepam™ Series 80 is equipped with two independent residual current inputs which may be connected to a zero sequence CT installed on the cables, tank grounding cable or neutral point of a transformer, or on the grounding cable of a motor or generator. In some cases, reading of the φ0 or φ'0 angle is impossible due to the position of the zero sequence CT (for example,: transformer tank grounding cable or neutral point) or because only one of the two Ir or Vr measurements is necessary or possible. When this is the case, simply check the measured residual current value Ir or I'r.

Procedure

1 Connect according to the diagram below:
- the generator voltage terminals to the voltage test terminal box using the plug provided
- a wire between the generator current terminals to inject current into the primary circuit of the zero sequence CT or CT, with:
  - the wire passing through the zero sequence CT or CT in the Pa-Pb direction
  - with P1 the bus end and P2 the cable end

2 Turn the generator on.

3 Apply a V_{Ln} voltage, set to the rated secondary voltage of the VTs, connected in a broken delta arrangement ($V_{LL}s / \sqrt{3}$ or Uns/3)

4 Inject a current set to 5A in phase with the voltage applied (generator phase displacement $\alpha(V_{Ln}, I) = 0°$)

5 Use the SFT2841 software to check the following:
- the value indicated for the measured Ir residual current is approximately equal to 5A
- the value indicated for the measured V0 residual voltage is approximately equal to the rated primary phase-to-neutral voltage of the VTs ($V_{Ln}p = V_{LL}p / \sqrt{3}$)
- the value indicated for the phase displacement φr(Vr, Ir) between the Ir current and Vr voltage is approximately equal to 0°

6 Use the same procedure if the I'r input is connected. When this is the case, the phase displacement angle you want to check is φ'r(Vr, I'r), between the I'r current and Vr voltage.

7 Turn the generator off when you finish the test.

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Checking Residual Current Input Connections

Description

Perform this check when residual current is measured by a specific sensor such as:

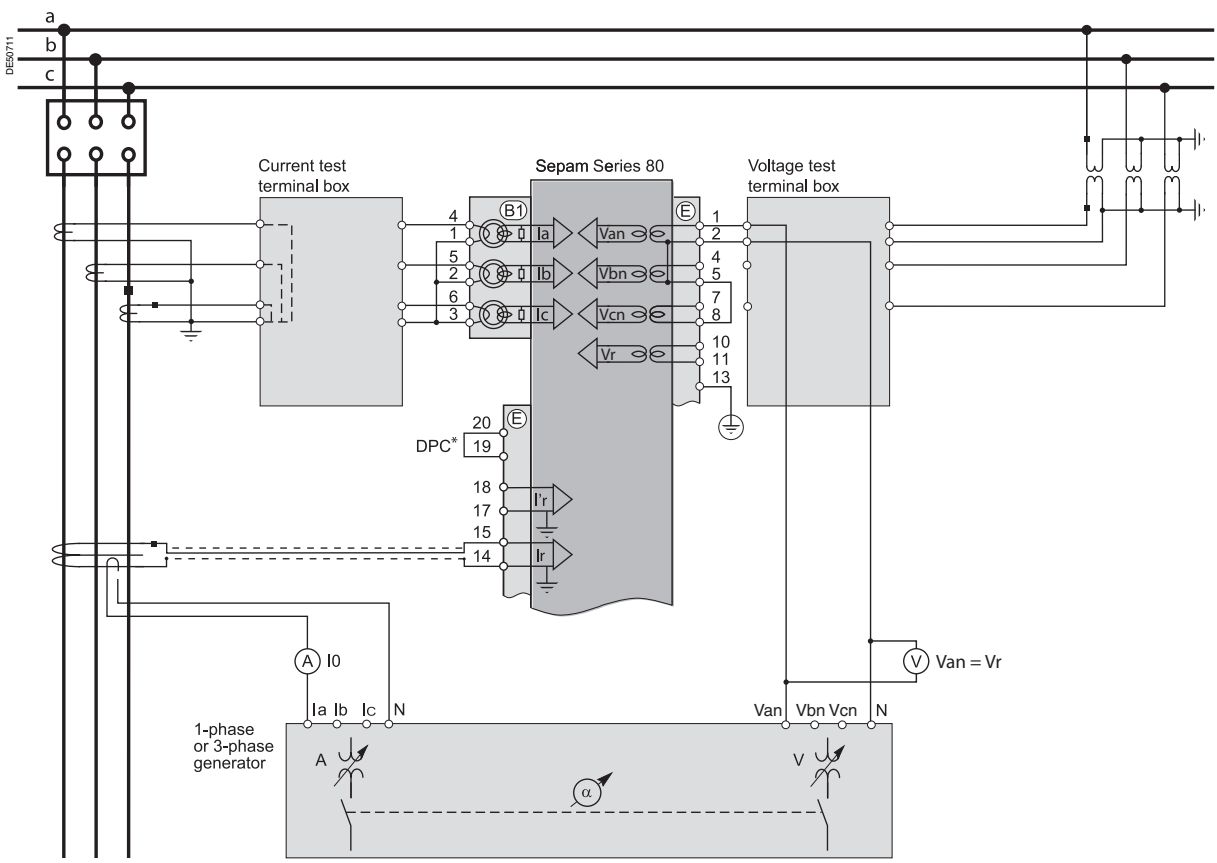
- CSH120 or CSH200 zero sequence CT
- CSH30 interposing ring CT (installed either on the secondary circuit of a single 1A or 5A CT which encompasses the three phases, or on the neutral connection of the three 1A or 5A phase CTs)
- other zero sequence CT connected to an ACE990 interface,

Perform this test when residual voltage is calculated in Sepam™, or cannot be calculated, as in an assembly with two VTs connected through their primary circuits. These are not available for the protection function.

Procedure

1 Connect according to the diagram below:
   - a wire between the generator current terminals to inject current into the primary circuit of the zero sequence CT or CT, with the wire passing through the zero sequence CT or CT in the Pa-Pb direction, with Pa the bus end and Pb the cable end
   - when applicable, the generator voltage terminals to the voltage test terminal box, so as to only supply Sepam's phase A voltage input and therefore obtain a residual voltage Vr = Va.
2 Turn the generator on.
3 When applicable, apply a V_N voltage set to the rated secondary phase-to-neutral voltage of the VT ($V_{Ln}s = V_{LL}s / \sqrt{3}$).
4 Inject an **I** current set to 5A, and when applicable in phase with the V_N voltage applied (specifically, generator phase displacement $\alpha(V_N, I) = 0°$).

Block Diagram



Note: *the number of CTs connected to the Sepam™ current connector phase inputs is given as an example and is not used for the test.*

** Detection of Plugged Connector (required for proper operation. Installed manually)*

DE50359

Sepam™ Series 80 is equipped with two independent residual current inputs which can be connected to a zero sequence CT installed on the cables, tank grounding cable or neutral point of a transformer, or on the grounding cable of a motor or generator. In some cases, reading of the φ0 or φ'0 angle is impossible due to the position of the zero sequence CT (for example,for example, transformer neutral point or tank grounding cable) or because only one of the two I0 or V0 measurements is necessary or possible. When this is the case, simply check the measured residual current value Ir or I'r.

5 Use the SFT2841 software to check the following:
   - the value indicated for the measured Ir residual current is approximately equal to 5A
   - when applicable, the value indicated for calculated Vr residual voltage is approximately equal to the rated primary phase-to-neutral voltage of the VTs ($V_{Np} = V_{LLp} / \sqrt{3}$)
   - when applicable, the value indicated for the phase displacement φr(Vr, Ir) between the Ir current and Vr voltage is approximately equal to 0°
6 Use the same procedure if the I'r input is connected. When this is the case, the phase displacement angle to be checked is φ'r(V'r, I'r), between the I'r current and Vr voltage.
7 Turn off the generator when the test is completed.

Check Appendix A, GFC Measuring Table for more information.

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Checking Residual Voltage Input Connections
With Voltage Delivered by 3 VT in Broken Delta Arrangement

Description

Perform this check when:

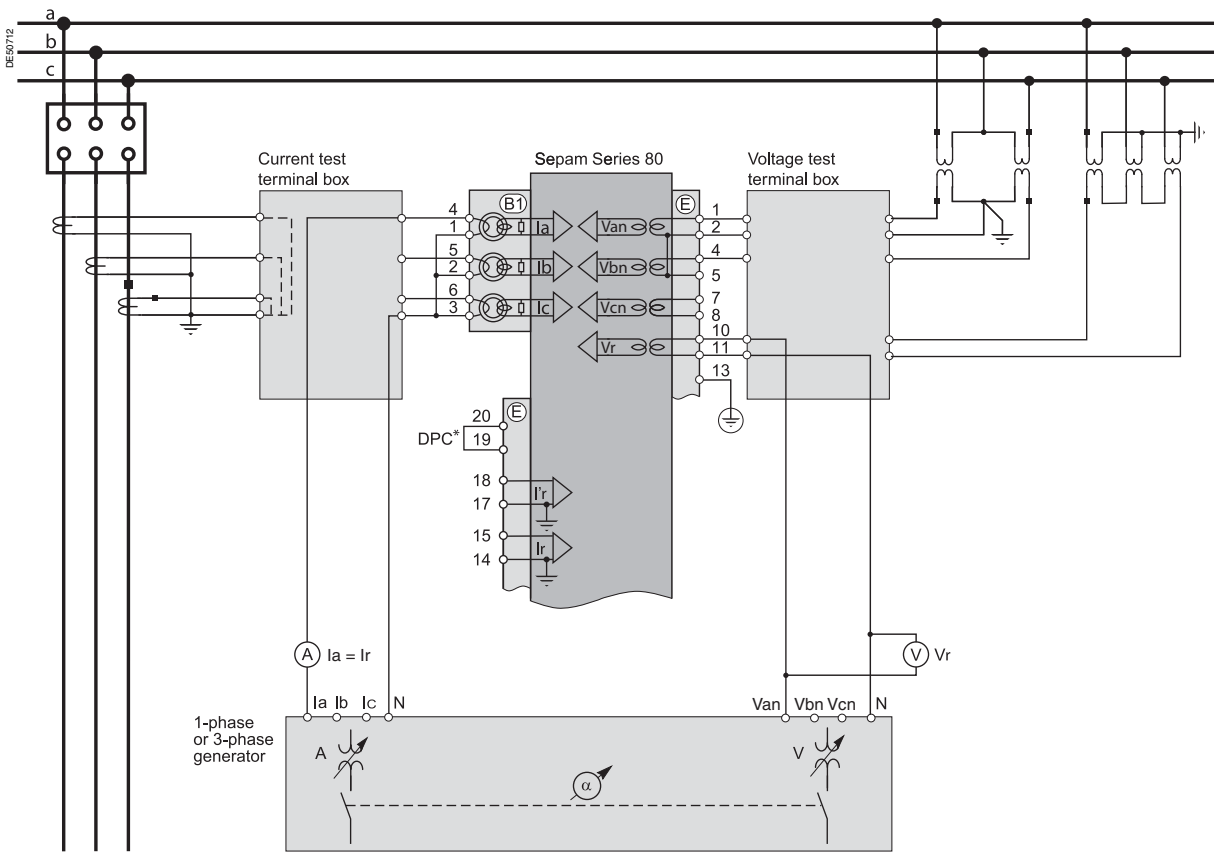
- residual voltage is delivered by three VTs on the secondary circuits connected in a broken delta arrangement
- the residual current is either calculated in Sepam™, or it cannot be calculated (for example,: assembly with two CTs) and is therefore not available for the protection function.

Procedure

Use the diagram below to perform the following steps

1. Connect generator voltage terminals to the voltage test terminal box. This will supply residual voltage input to Sepam™
2. When applicable, connect the generator current terminals to the current test terminal box, to supply Sepam's phase 1 current input. This provides a residual current $Ir\Sigma = Ia$.
3. Turn the generator on.
4. Apply a V_{Ln} voltage set to the rated secondary voltage of the VTs installed in a broken delta arrangement (depending on the case, $V_{LL}s / \sqrt{3}$ or Uns/3).

Block Diagram



Note: *The number of VTs connected to the Sepam™ voltage connector phase inputs is given as an example and is not used for the test.*

** Detection of Plugged Connector (required for proper operation. Installed manually)*

5. When applicable, inject an *Ia* current set to the rated secondary current of the CTs (1 A or 5 A) and in phase with the voltage applied (specifically, generator phase displacement $\alpha(V_{Ln}, I) = 0°$).
6. Use the SFT2841 software to check the following:
   - the value indicated for measured V0 residual voltage is approximately equal to the rated primary phase-to-neutral voltage of the VTs ($V_{Ln}p = V_{LLp} / \sqrt{3}$)
   - when applicable, the value indicated for the calculated $Ir\Sigma$ residual current is approximately equal to the rated primary current of the CTs
   - when applicable, the value indicated for the phase displacement $\varphi r\Sigma$ (Vr, $Ir\Sigma$) between the $Ir\Sigma$ current and Vr voltage is approximately equal to 0°
7. Turn the generator off when the test is completed.

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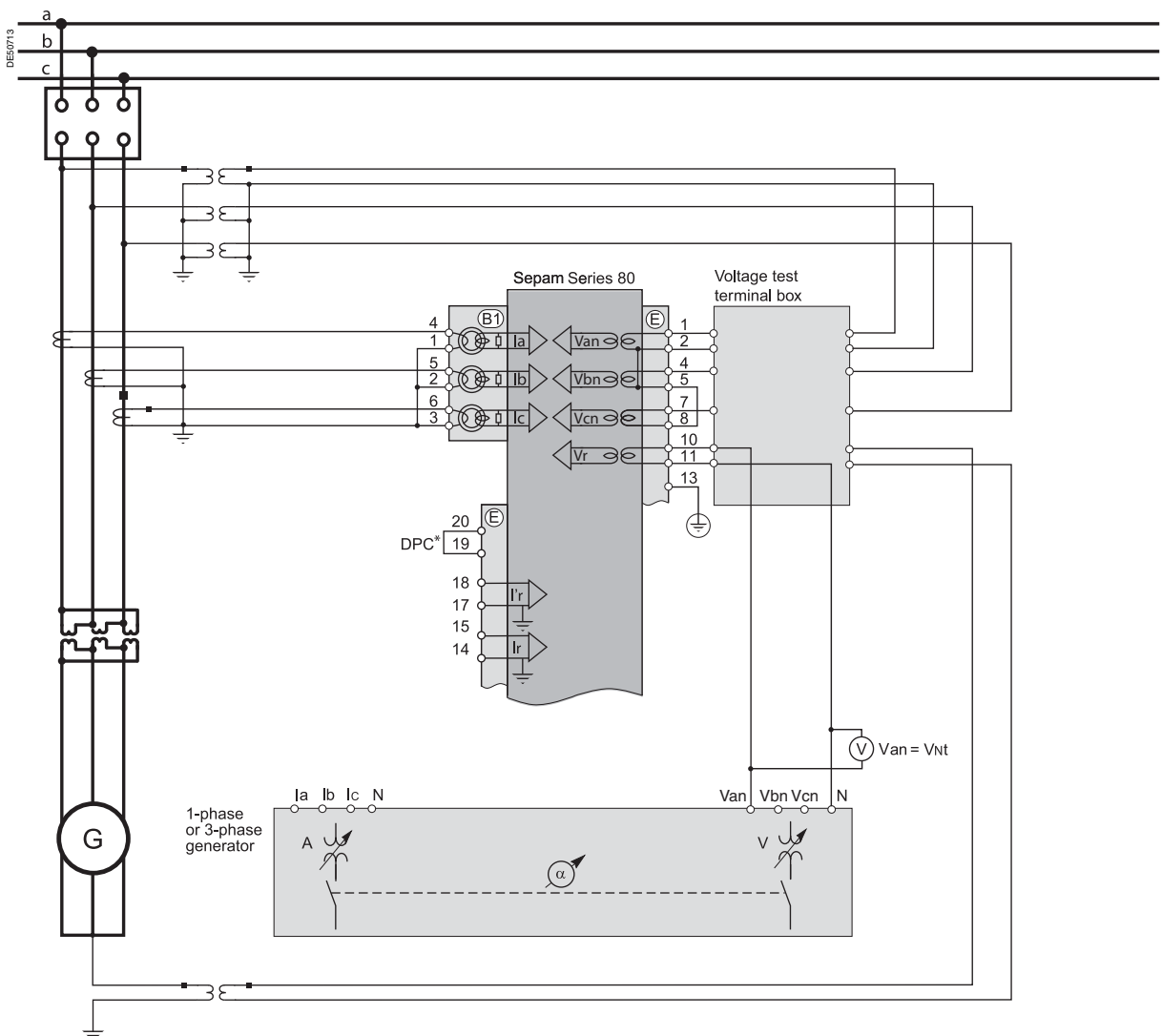
Checking Residual Voltage Input Connections
With Voltage Delivered by 1 Neutral Point VT

Description

Perform this check when the Sepam™ residual voltage input is connected to one VT installed on the neutral point of a motor or generator (in which case the VT is a power transformer).

Block Diagram



Note: *the number of CTs/VTs connected to the Sepam™ current/voltage connector phase inputs is given as an example and is not used for the test.*

** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

Use the diagram above to perform the following steps

1. Connect the generator voltage terminals to the voltage test terminal box, so as to only supply Sepam's residual voltage input.
2. Turn the generator on.
3. Apply a V_N voltage set to the rated secondary voltage of the neutral point VT (that is, $V'_{Ln}ts$).
4. Use the SFT2841 software to check that the measured neutral point voltage V_{Nt} is approximately equal to the rated primary phase-to-neutral voltage of the VTs ($V'_{Ln}ts$).
5. Turn the generator off when the test is completed.

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Checking Sepam™ B80 Additional Voltage Input Connections

Description

Conduct this check on Sepam™ B80 units with additional phase voltage measurement. This does not check the main voltage input connections.

The additional phase voltage the Sepam™ B80 measures is either phase-to-neutral voltage V'an or phase-to-phase voltage V'ab. This is determined by the VT connected and the Sepam™ parameter setting mode.

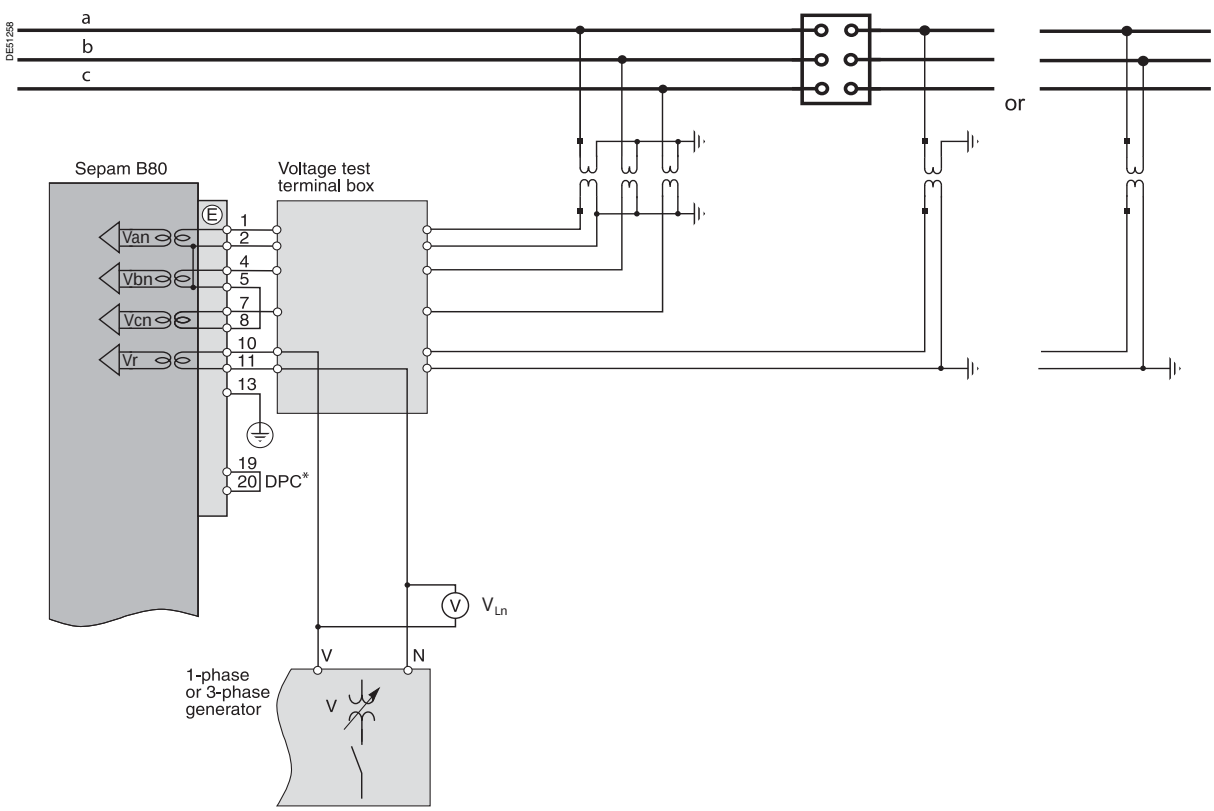
Since the additional voltage measured is not related to the currents measured by Sepam™ B80, it is not necessary to inject current to check the Sepam™ B80 additional voltage input connection.

Procedure

Use the diagram below to perform the following steps

1 Connect the single-phase voltage generator to the corresponding test terminal box, using the plugs provided, according to the diagram for the voltages measured:
   - **block diagram 1:** Sepam™ B80 measures the three main phase voltages and an additional phase voltage
   - **block diagram 2:** Sepam™ B80 measures two main phase voltages, the main residual voltage and an additional phase voltage.
2 Turn the generator on.
3 Apply a voltage V_N set to the rated secondary voltage of the additional VT ($V'_{Ln}s = V'_{LL}s / 3$).
4 Use the SFT2841 software to check that the measured voltage indicated V'an or V'ab is approximately equal to the VT's rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LL}p / 3$).
5 Turn the generator off.

Block Diagram 1



** Detection of Plugged Connector (required for proper operation. Installed manually)*

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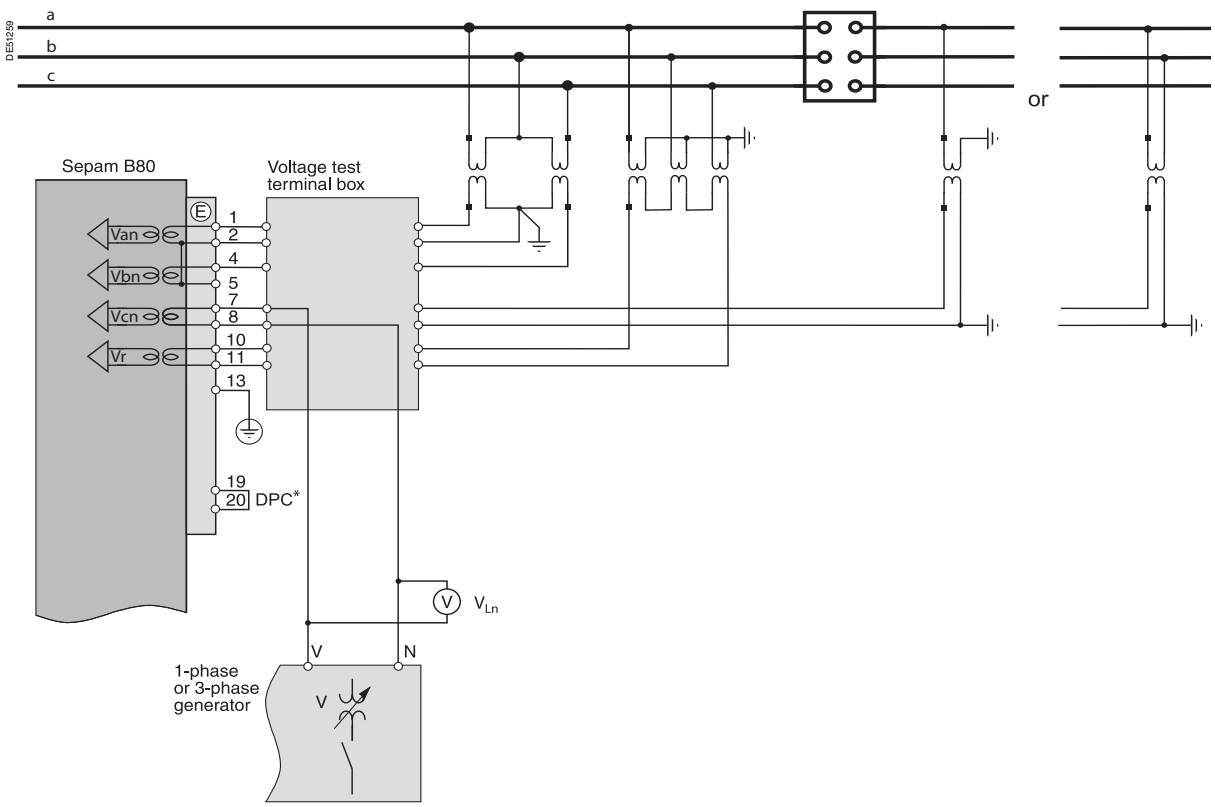
Checking Sepam™ B80 Additional Voltage Input Connections

Block Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

Use the diagram above to perform the following steps

1. Turn the generator on.
2. Apply a voltage V_N set to the rated secondary voltage of the additional VT ($V'_{Ln}s = V'_{LLs} / \sqrt{3}$).
3. Use the SFT2841 software to check that the measured voltage indicated V'an or V'ab is approximately equal to the VT's rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LLp} / \sqrt{3}$).
4. Turn the generator off when testing is complete.

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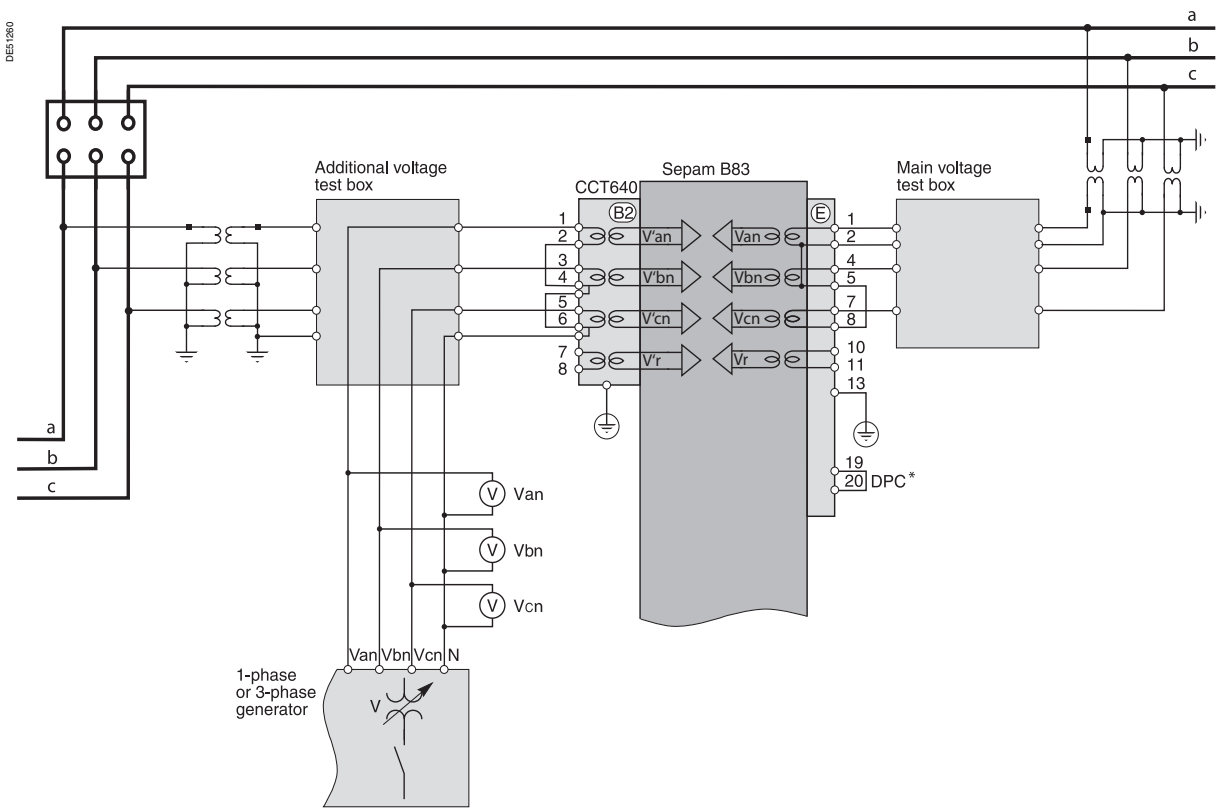
Checking Sepam™ B83 Additional Phase Voltage Input Connections

Description

Perform this check on Sepam™ B83 units with additional phase voltage measurement. This does not check the main voltage input connections.

Since the additional voltages measured are unrelated to the currents measured by Sepam™ B83, it is not necessary to inject current to check the Sepam™ B83 additional phase voltage input connections.

Block Diagram with Three Additional VTs



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

Connect the voltage generator to the corresponding test terminal box, using the plugs provided, according to the diagram for the number of VTs connected to Sepam™.

Perform the test in the next column as determined by the generator you are using.

Procedure

Use the diagram above to perform the following tests.

Checking with a Three-Phase Voltage Generator

1. Turn the generator on.
2. Apply the three generator voltages Van, Vbn, Vcn, balanced and set to the rated secondary phase-to-neutral voltage of the additional VTs ($V'_{Ln}s = V'_{LL}s / \sqrt{3}$).
3. Use the SFT2841 software to check that the values indicated for each of the phase-to-neutral voltages V'an, V'bn, V'cn, and the positive sequence voltage V'1 are approximately equal to the VT's rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LL}p / \sqrt{3}$)
4. Turn the generator off when you finish the test.

Checking with a Single-Phase Voltage Generator

1. Turn the generator on.
2. Apply the generator voltage V_N set to the rated secondary phase-to-neutral voltage of the additional VTs ($V'_{Ln}s = V'_{LL}s / \sqrt{3}$) across the Sepam™ phase A voltage input terminals.
3. Use the SFT2841 software to check that the value indicated for the phase-to-neutral voltage V'an is approximately equal to the VT's rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LL}p / \sqrt{3}$).
4. Proceed in the same way by circular permutation with phase b and phase c voltages, to check the V'bn and V'cn values.
5. Turn the generator off when you finish the test.

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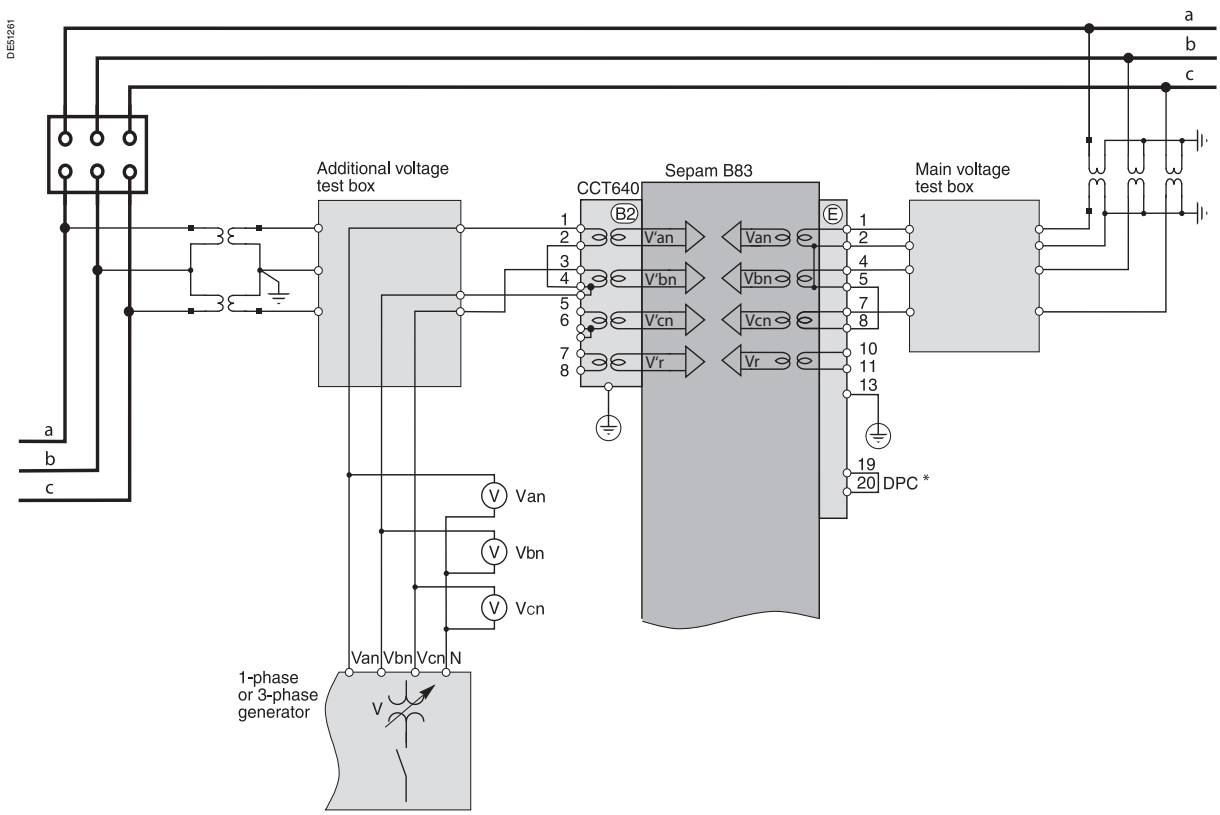
Checking Sepam™ B83 Additional Phase Voltage Input Connections

Block Diagram with Two Additional VTs



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

Use the diagram above to perform the following steps

Checking with a Three-Phase Voltage Generator

1. Turn the generator on.
2. Apply the three generator voltages Van, Vbn, Vcn, balanced and set to the rated secondary phase-to-neutral voltage of the additional VTs ($V'_{Ln}s = V'_{LL}s / \sqrt{3}$)
3. Use the SFT2841 software to check that:
   - the values indicated for each of the phase-to-neutral voltages V'an, V'bn, V'cn, and the positive sequence voltage V'1 are approximately equal to the VT's rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LLp} / \sqrt{3}$)
   - the value of each of the phase-to-phase voltages V'ab, V'bc, V'ca is equal to the VT's rated primary phase-to-phase voltage ($V'_{Ln}p$)
4. Turn the generator off.

Checking with a Single-Phase Voltage Generator

1. Turn the generator on.
2. Apply the generator voltage V_{Ln} set to the rated secondary phase-to-neutral voltage of the additional VTs ($V'_{Ln}s = V'_{LLs} / \sqrt{3}$) across Sepam™ voltage input terminals 1 and 5 (via the text box).
3. Use the SFT2841 software to check that the value indicated for the phase-to-neutral voltage V'ab is approximately equal to the VT's rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LLp} / \sqrt{3}$).
4. Apply the generator voltage V-N set to the rated secondary phase-to-neutral voltage of the additional VTs ($V'_{Ln}s = V'_{LLs} / \sqrt{3}$) across Sepam™ voltage input terminals 3 and 5 (via the text box).
5. Use the SFT2841 software to check that the value indicated for the phase-to-neutral voltage V'bc is approximately equal to the VT's rated primary phase-to-neutral voltage($V'_{Ln}p = V'_{LLp} / \sqrt{3}$).
6. Turn the generator off when you finish this test.

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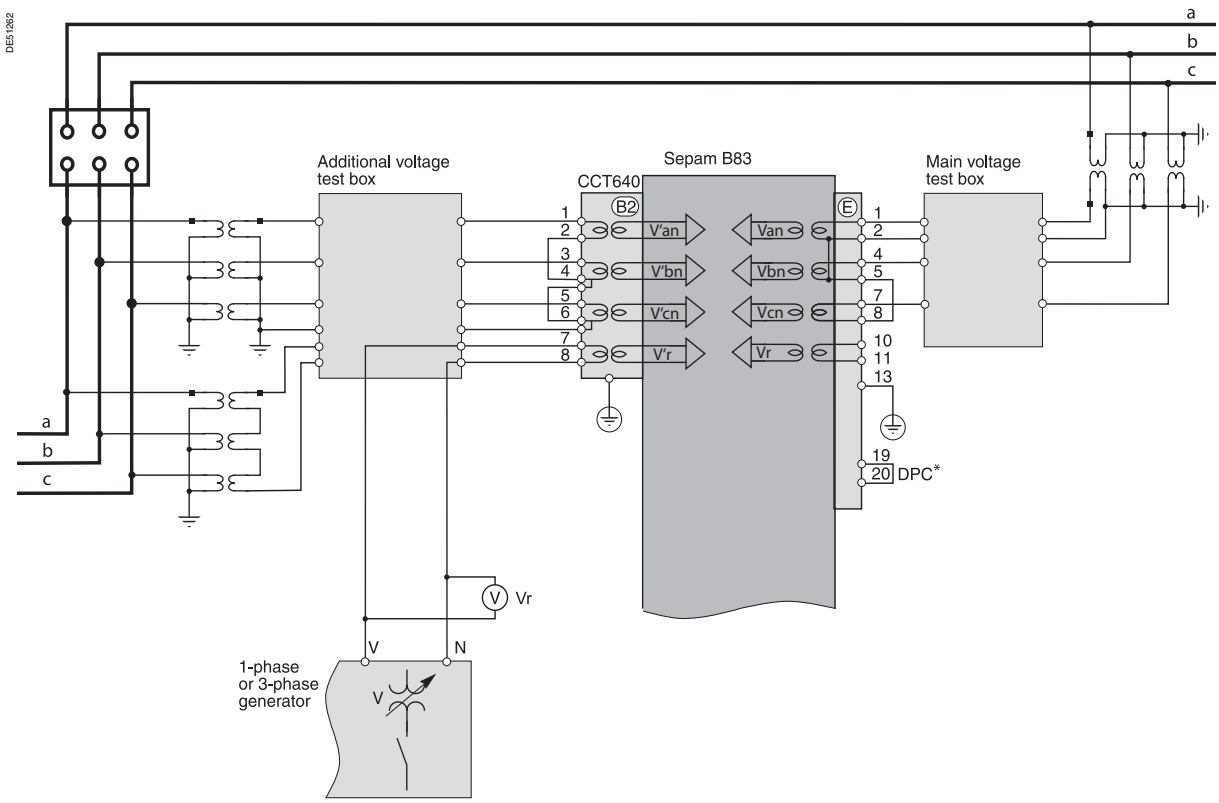
Checking Sepam™ B83 Additional Residual Voltage Input Connections

Description

Perform this check on Sepam™ B83 units with additional voltage measurement. This does not check the main voltage input connections.

Since the additional residual voltage is unrelated to the currents measured by Sepam™ B83, it is not necessary to inject current to check Sepam™ B83 additional residual voltage input connection.

Block Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Procedure

Use the diagram above to perform the following steps

1. Connect the single-phase voltage generator to the corresponding test terminal box according to the block diagram above. Use the plugs provided
2. Turn the generator on.
3. Apply the generator voltage V_{Ln} set to the rated secondary voltage of the additional VTs mounted in a broken delta arrangement (depending on the case, $V'_{LLp} / \sqrt{3}$ or $V'_{LLs} / 3$).
4. Use the SFT2841 software to check that the value indicated for the residual voltage measured V'r is approximately equal to the VTs' rated primary phase-to-neutral voltage ($V'_{Ln}p = V'_{LLp} / \sqrt{3}$).
5. Turn the generator off when you finish this test.

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Checking Sepam™ C86 Unbalance Current Input Connections

Description

Perform this test on Sepam™ C86 units with measurement of capacitor unbalance currents. This does not check the phase current input connections.

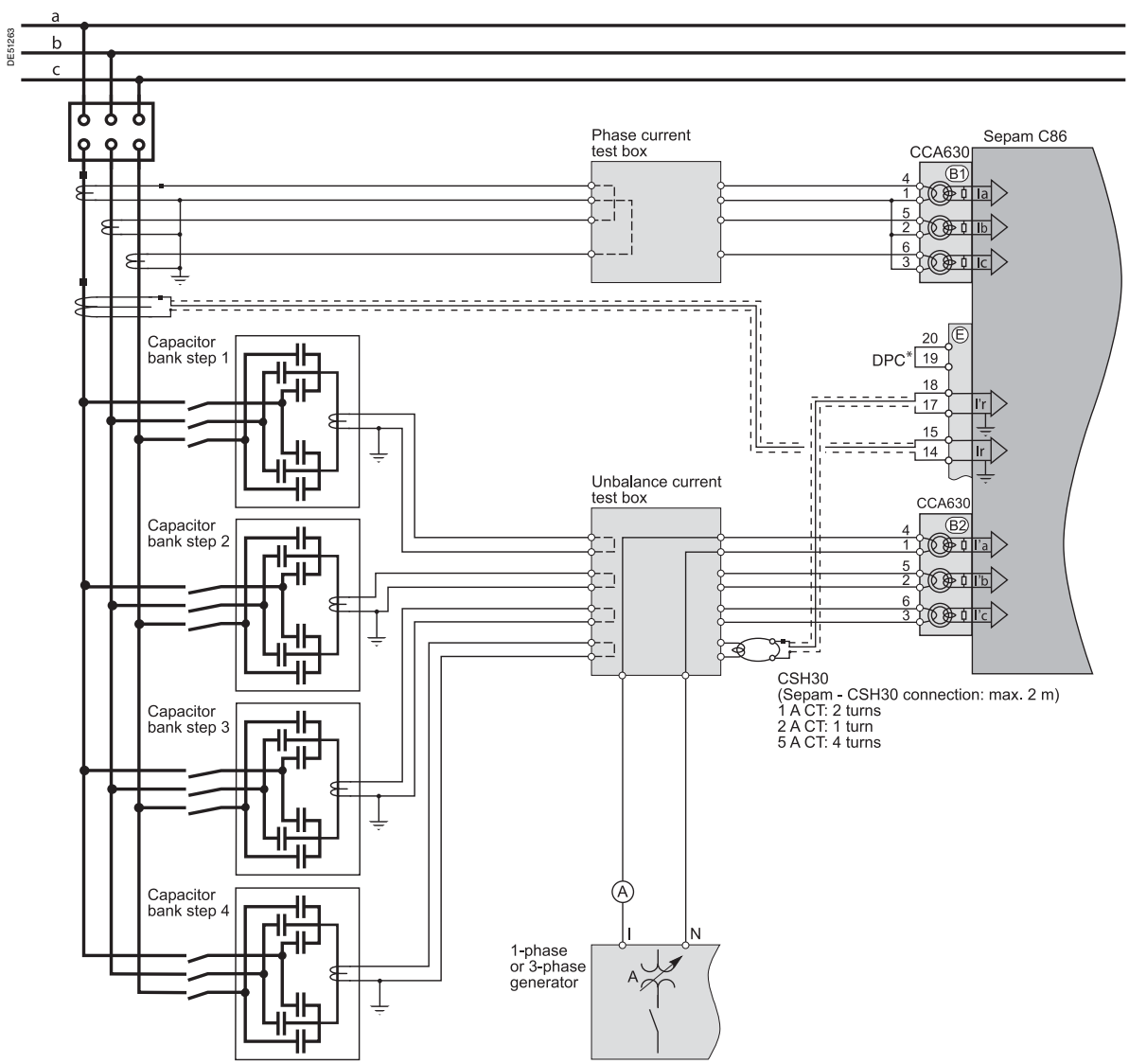
Since the capacitor unbalance currents are not related to the voltages measured by Sepam™ C86, it is not necessary to inject voltage to check the Sepam™ C86 capacitor unbalance current input connections.

Procedure

Use the diagram below to perform the following steps

1. Connect the single-phase current generator to the corresponding test terminal box, using the plugs provided, according to the block diagram below.
2. Turn the generator on.
3. Inject the generator current I set to the CTs' rated secondary current (1A, 2A or 5A) to Sepam's step 1 unbalance input (via the test box).
4. Use the SFT2841 software to check that the unbalance current value indicated I'a is approximately equal to the CTs' rated primary current.
5. Proceed in the same way by circular permutation with the unbalance currents of steps 2, 3, and 4, to check the I'b, I'c and I'r values.
6. Turn the generator off when you finish this test.

Block Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Check Appendix A, GFC Measuring Table for more information.

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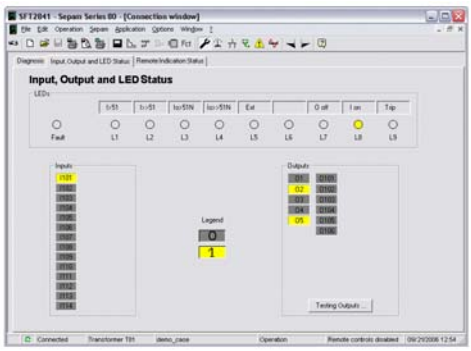
Checking Logic Input & Output Connections

Checking Logic Input Connections

PE50146



SFT2841: input, output, indicator status

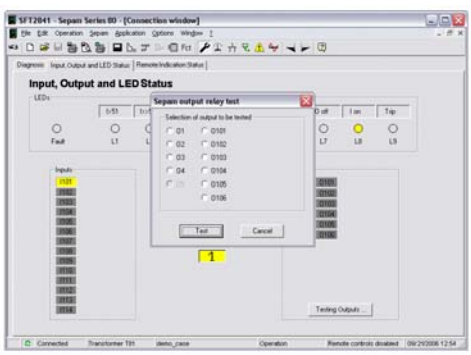
Procedure

Proceed as follows for each input:

1. **If the input supply voltage is present,** use an appropriate electric cord to short-circuit the contact that delivers logic data to the input.
2. **If the input supply voltage is not present,** apply a voltage supplied by the DC voltage generator to the terminal of the contact linked to the chosen input. Observe polarity and level.
3. Use the **Input, output, indicator status** screen of the SFT2841 software to observe the change of status of the input.
4. Press the SFT2841 **Reset** key as necessary to clear all messages and deactivate all outputs at the end of the test.

Checking Logic Output Connections

PE50147



SFT2841: output relay test

Procedure

This test uses the "Output relay test" function from the SFT2841 software in the **Sepam™ Diagnosis** screen.

When it is used for the watchdog, only output O5 can be tested.

1. This function requires prior entry of the "Parameter setting" password.
2. Activate each output relay using the buttons in the SFT2841 software. The activated output relay changes status over a period of 5 seconds.
3. Observe the change of status of the output relay through the operation of the related switchgear, if it is ready to operate and is powered, or connect a voltmeter to the terminals of the output contact. The voltage cancels itself out when the contact closes.
4. At the end of the test, press the SFT2841 Reset key to clear all messages and deactivate all outputs.

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Checking Optional Module Connections

MET1482 Module Temperature Sensor Inputs

Sepam™ T81, T82, T87, M81, M87, M88, G82, G87, G88, and C86 units provide a temperature monitoring function that checks the connection of each RTD that is configured.

An **RTD FAULT** alarm is generated whenever one of the RTDs is detected as being short-circuted or disconnected (absent).

To identify faulty RTD(s):

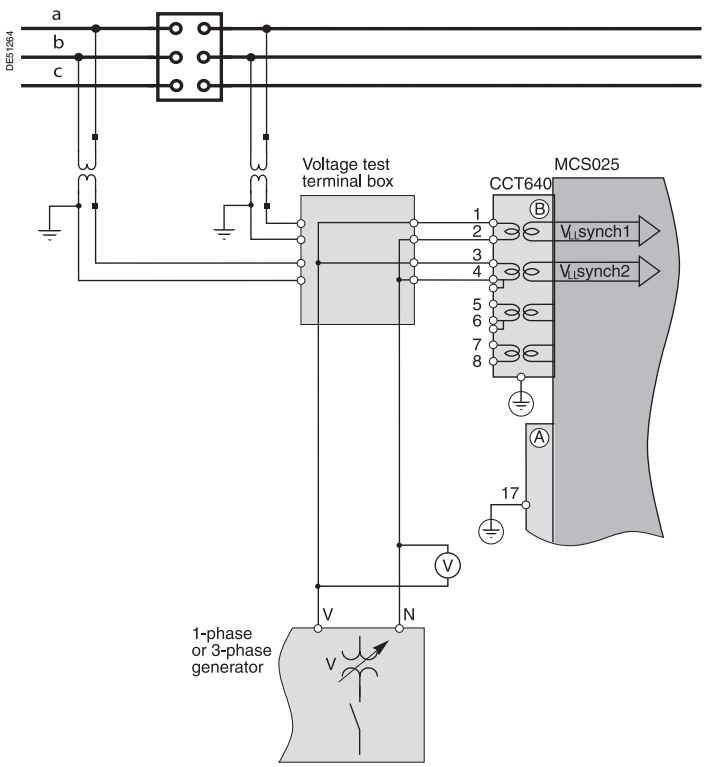
1 Display the temperature values measured by Sepam™ using the SFT2841 software.
2 Check the consistency of the temperatures measured:
- the temperature displayed is "*****" if the RTD is short-circuited (T < –35 °C or T < –31° F)
- the temperature displayed is "-*****" if the RTD is disconnected (T > 205 °C or T > 401° F)

MSA141 Module Analog Output

1 Identify the measurement associated by parameter setting to the analog output using the SFT2841 software.
2 Simulate, if necessary, the measurement linked to the analog output by injection.
3 Check the consistency between the value measured by Sepam™ and the indication given by the device connected to the analog output.

MCS025 Module Voltage Inputs

Block Diagram



Procedure

1 Connect the single-phase voltage generator to the corresponding test terminal box, using the plugs provided, according to the block diagram below.
2 Turn the generator on.
3 Apply a voltage V_{Ln} set to the rated secondary voltage V_{Ln}s sync1 (V_{LL}s sync1= V_{LL}s sync1 / $\sqrt{3}$) in parallel between the input terminals of the two voltages to be synchronized.
4 Use the SFT2841 software to check that:
- the measured voltage difference dV_{LL}, frequency difference dF and phase difference $d\phi$ values are equal to 0
- the close enable sent by the MCS025 module is received on the Sepam™ series 80 logic input assigned to this function (logic input in 1 status in the "Input, output and LED status" screen)

5 Use the SFT2841 software to check that for the other Sepam™ Series 80 units concerned by the "Sync-check" function the close enable sent by the MCS025 module is received on the logic input assigned to this function (logic input in 1 status in the "Input, output and LED status" screen).
6 Turn the generator off.

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Validating the Complete Protection Chain

Principle

The complete protection chain is validated during a fault simulation that causes Sepam™ to trip the breaking device.

Procedure

1. Select one of the protection functions that triggers tripping of the breaking device and separately, according to their incidence in the chain, the function or functions related to the programmed or reprogrammed parts of the program logic.
2. According to the selected function or functions, inject a current and/or apply a voltage that corresponds to a fault.
3. Observe the tripping of the breaking device and the operation of the adapted parts of the program logic.

Place the covers on the test terminal boxes when you complete the voltage and current application type checks.

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Test Sheet
Sepam™ Series 80

Project: **Type of Sepam™**

Switchboard: **Serial Number**

Cubicle: **Software Version** V

Overall Checks
Check ☐ when the check is made and is conclusive

Type of Check	
Preliminary general examination, prior to energizing	☐
Energizing	☐
Parameter and protection settings	☐
Logic input connections	☐
Logic output connections	☐
Validation of the complete protection chain	☐
Validation of the adapted functions (via the logic equation editor or via Logipam)	☐
Analog output connection to the MSA141 module	☐
Temperature sensor input connections to the MET148-2 module	☐
Voltage input connections to the MCS025 module	☐

Checing Phase Current and Voltage Inputs
Check ☐ when the check is made and is conclusive

Type of Check	Test Performed	Result	Display	
Phase current and phase voltage input connections	Secondary injection of CT rated current into (B1), 1A or 5A	Rated primary current of CTs connected to (B1)	Ia =.....	☐
			Ib =.....	☐
			Ic =.....	☐
	Secondary injection of phase voltage (the value to inject depends on the test being performed)	VT rated primary phase-to-neutral voltage $V_{LLp}/\sqrt{3}$	Va = ...	☐
			Vb = ...	☐
			Vc =.....	☐
		Phase displacement $\varphi(V, I) \cong 0°$	φa =.....	☐
			φb =.....	☐
			φc =.....	☐
Phase current input connections for differential applications	Secondary injection of CT rated current into (B1)/(B2), 1A or 5A (1A if secondary ratings are different)	Primary In (or In/5) of CTs connected to (B1) (depending on secondary ratings)	Ia =.....	☐
			Ib =.....	☐
			Ic =.....	☐
		Primary I'n (or I'n/5) of CTs connected to (B2) (depending on secondary ratings)	I'a =.....	☐
			I'b =.....	☐
			I'c =.....	☐
		Phase displacement $\theta(I, I') \cong 0°$	θ(Ia, I'a) =.....	☐
			θ(Ib, I'b) =.....	☐
			θ(Ic, I'c) =.....	☐

Tests performed on: .....

By: .....

Signatures

Comments:

.....

.....

.....

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Test Sheet
Sepam™ Series 80

Project: **Type of Sepam™:**

Switchboard: **Serial Number:**

Cubicle: **Software Version:** V

Residual Current / Voltage Input Checks

Check ☐ when the check is made and is conclusive

Type of Check	Test Performed	Result	Display
Residual current input connection	Injection of 5A into the core balance CT primary circuit	Injected current value Ir and/or I'r	I0 = ... ☐ I'0 = ... ☐
	When applicable, secondary injection of the rated phase-to-neutral voltage of a phase VT $V_{LL}s/\sqrt{3}$	VT rated primary phase-to-neutral voltage $V_{LL}p/\sqrt{3}$	V0 = ... ☐
		Phase displacement φr(Vr, Ir) and/or φ'r(V'r, I'r) ≅ 0°	φ0 = ... ☐ φ'0 = ... ☐
Residual voltage input connection To three VTs in open delta arrangement	Secondary injection of the rated voltage of the VTs in a broken delta arrangement ($V_{Ln}p/\sqrt{3}$ or $V_{LL}p/3$)	VT rated primary phase-to-neutral voltage $V_{Ln}p/\sqrt{3}$	V0 = ... ☐
	When applicable, secondary injection of CT rated current, 1A or 5A	CT rated primary current	I0Σ = ... ☐
		Phase displacement φrΣ(Ir, IrΣ)	φ0Σ = ... ☐
To one neutral point VT	Secondary injection of the rated voltage of the neutral point VT (Vnts)	VT rated primary phase-to-neutral voltage Vntp	Vnt = ... ☐
Residual current and residual voltage input connections	Injection of 5A into the core balance CT primary circuit	Injected current value Ir and/or I'r	I0 = ... ☐ I'0 = ... ☐
	Secondary injection of the rated voltage of the VTs in a broken delta arrangement ($V_{LL}p/\sqrt{3}$ or $V_{LL}p/3$)	VT rated primary phase-to-neutral voltage $V_{LL}p/\sqrt{3}$	V0 = ... ☐
		Phase displacement φr(Vr, Ir) and/or φ'r(V'r, I'r) ≅ 0°	φ0 = ... ☐ φ'0 = ... ☐

Tests performed on:	**Signatures**
By:.....	

Comments:

.....

.....

.....

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Test Sheet
Sepam™ Series 80

Project: **Type of Sepam™**

Switchboard: **Serial Number**

Cubicle: **Software Version** V

Special Checks

Check ☐ when the check is made and is conclusive

Type of Check	Test Performed	Result	Display
Sepam™ B80: additional phase voltage input connection	Secondary injection of the rated phase-to-neutral voltage of an additional phase VT $V'_{LLp} / \sqrt{3}$	Rated primary voltage of additional VTs $V'_{LLp}/\sqrt{3}$	V'a or V'ab = ... ☐
Sepam™ B83: additional phase voltage input connections	Secondary injection of the additional rated phase to neutral voltage $V'_{LLp} / \sqrt{3}$	Rated primary phase-to-neutral voltage of additional VTs $V'_{LLp} / \sqrt{3}$	V'a =..... ☐ V'b =..... ☐ V'c =..... ☐ V'd =..... ☐
Sepam™ B83: additional residual voltage input connection	Secondary injection of the rated phase-to-neutral voltage of VTs in a broken delta arrangement ($V'_{LLp} / \sqrt{3}$ or $V'_{LLp}/3$)	Rated primary phase-to-neutral voltage of additional VTs $V'_{LLp} / \sqrt{3}$	V'a =..... ☐
Sepam™ C86: unbalance current input connections	Secondary injection of the CT rated current, 1A, 2A or 5A	CT rated primary current	I'a =..... ☐ I'b =..... ☐ I'c =..... ☐ I'0 =..... ☐

Tests performed on: .....

By: .....

Signatures

Comments:

.....

.....

.....

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Contents

Troubleshooting Assistance **146**
Replacing the Base Unit Replacing the Battery **150**

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Nothing happens when Sepam™ is switched on:

- all LEDs off
- nothing displayed on Sepam™ display.

Auxiliary Power Fault	
Possible Cause	**Action / Remedy**
Connector A not plugged in.	Plug in connector A.
Connectors A and E reversed.	Put connectors in correct positions.
Auxiliary power absent.	Check the auxiliary power level (range = 24 V DC to 250 V DC).
Polarities reversed on terminals 1 and 2 of connector A.	Check that the + polarity is on terminal 1 and the – polarity on terminal 2. Correct if necessary.
Internal problem.	Change base unit (see page 150)

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Troubleshooting Assistance

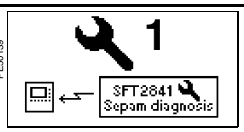
PE50359

Major faults are only cleared after the cause of the fault is corrected and Sepam™ is switched on again.

MAJOR Fault: Sepam™ is in Fail-Safe Position

- ON LED of UMI on in front
- LED of UMI on in front
  or LED of DSM303 remote advanced UMI flashing
- green LED on rear panel on
- red LED on rear panel on

PE50139



Fault message on display: major fault

No Connection made with SFT2841	
Possible Cause	**Action / Remedy**
Memory cartridge absent.	Switch off Sepam™. Install the memory cartridge and secure it by tightening the two integrated screws. Switch Sepam™ on again (see page 150).
Major internal fault.	Change base unit.

Connection made with SFT2841	
Possible Cause	**Action / Remedy**
SFT2841 indicates major fault, but no missing module: Base unit internal fault.	Change base unit.
Memory cartridge not compatible with version of the base unit (see below).	Note the version using the SFT2841 software, Diagnosis screen. Contact the local support team.
The hardware configuration is incorrect or incomplete.	Use the SFT2841 software, in connected mode, to determine the cause. The SFT2841 Diagnosis screen displays the missing items in red (see table below).

Check on hardware configuration using SFT2841		
Diagnosis screen	**Possible cause**	**Action / remedy**
CCA630, CCA634, CCA671 or CCA640 connector in **B1** or **B2** position displayed in red.	Connector absent.	Install a connector. If the connector is present, check that it is plugged in correctly and held in place by the two screws.
	LPCT sensors not connected.	Connect the LPCT sensors.
Connector in position **E** displayed in red.	Connector **E** unplugged or no jumper between terminals 19 and 20.	Plug in connector E. Fit the jumper.
MES120 module in **H1**, **H2** or **H3** position displayed in red.	MES120 module absent.	Install MES120 module. If the MES120 module is present, check that it is plugged in correctly and held in place by the two screws. If the fault is still present, replace the module.

PE10156

Fault message displayed if cartridge is not compatible

Rules on Compatibility Between the Cartridge and the Base Unit

The major index of the base-unit version must be greater than or equal to the major index of the cartridge-application version.

Example: The base unit with a version V1.05 (major index = 1) and an application with a version V2.00 (major index = 2) are not compatible.

If this rule is not observed, a major fault occurs and Sepam™ displays the message in the left column.

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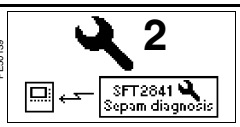
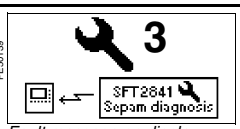
MINOR Fault: Sepam™ is operating in Downgraded Mode

- ON LED of UMI on in front
- LED of UMI flashing in front
- green LED on rear panel on
- red LED on rear panel flashing



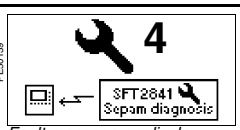
Fault message on display: inter-module link fault

Inter-Module Link Fault	
Possible Cause	**Action / Remedy**
Faulty wiring	Check remote module connections: RJ45 plugs of CCA77x cables clipped correctly into sockets.



Fault message on display: MET1482 not available

MET1482 Module not Available		
LEDs	**Possible Cause**	**Action / Remedy**
MET1482 Green and Red LEDs off	Faulty wiring.	Check module connections: RJ45 plugs of CCA77x cables clipped correctly into sockets.
MET1482 Green LED on MET1482 Red LED off	No response from MET1482 module	Check the position of the module number selection jumper ■ MET1 for first MET1482 module (temperatures T1 to T8) ■ MET2 for second MET1482 module (temperatures T9 to T16). ■ If the jumper position needs to be changed, reboot the MET1482 module by disconnecting and reconnecting the interconnection cord
MET1482 Red LED flashing.	Faulty wiring, MET1482 powered but loss of dialogue with base unit.	Check module connections: RJ45 plugs of CCA77x cables clipped correctly into sockets. If the MET1482 module is the last in the chain, make sure the line terminating jumper is in the **Rc** position. In all other cases, the jumper should be in the position marked ~~Rc~~.
MET1482 Red LED on.	More than three remote modules connected to D1 or D2 on base unit.	Distribute remote modules between D1 and D2.
	MET1482 module internal fault.	Change MET1482 module.



Fault message on display: MSA141 not available

MSA141 Module Not Available		
LEDs	**Possible Cause**	**Action / Remedy**
MSA141 Green and Red LEDs off.	Faulty wiring, MSA141 not powered.	Check module connections: RJ45 plugs of CCA77x cables clipped correctly into sockets.
MSA141 Green LED on. MSA141 Red LED flashing.	Faulty wiring, MSA141 powered but loss of dialogue with base unit.	Check module connections: RJ45 plugs of CCA77x cables clipped correctly into sockets. If the MSA141 module is the last in the chain, check that the line terminating jumper is in the **Rc** position. In all other cases, the jumper should be in the position marked ~~Rc~~.
MSA141 Red LED on.	More than three remote modules connected to D1 or D2 on base unit.	Distribute remote modules between D1 and D2.
	MSA141 module internal fault.	Change MSA141 module.

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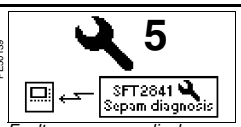
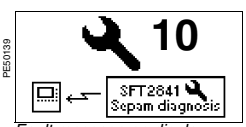


Fault message on display:
MCS025 not available

MCS025 Module Not Available		
LEDs	**Possible Cause**	**Action / Remedy**
MCS025 LED flashing.	Faulty wiring, MCS025 powered but loss of dialogue with base unit.	Check that a CCA785 cord is used with orange RJ45 plug on MCS025 end. Check module connections: RJ45 plugs of CCA785 cord clipped correctly into sockets.
MCS025 LED on.	Internal fault or MCS025 fault.	Check connections (DPC function - detection of plugged connector).

DSM303 Module Not Avaliable		
LEDs	**Possible Cause**	**Action / Remedy**
DSM303 LED on and display off.	Module internal fault.	Replace the DSM303 module.

Faulty Sepam™ UMI		
Display	**Possible Cause**	**Action / Remedy**
Advanced or mimic-based UMI display off.	Display internal fault.	Replace the base unit. See page 150.



Fault message on display:
CPU overload

Sepam™ CPU Overload Detection	
Possible Cause	**Action / Remedy**
The application configured exceeds the CPU capacity of the Sepam™ Series 80.	Reduce the size of the Logipam program used on the Sepam™ Series 80, or switch off some protection functions. For further information, contact your local support center.

Alarms

"METx FAULT" Message.

RTD Fault	
Possible Cause	**Action / Remedy**
An RTD on a MET1482 module is disconnected or short-circuited.	Since the alarm is common to the eight channels of the module, go to the temperature measurement display screen to determine which channel is affected by the fault. Measurement displayed: ■ Tx.x = -**** = RTD disconnected (T > 205 °C (401 °F)) ■ Tx.x = **** = RTD short-circuited (T < –35 °C (–31 °F))

"**BATTERY LOW**" message.

Battery Fault	
Possible Cause	**Action / Remedy**
Battery low, absent or incorrectly installed.	Replace the battery. See page 150.

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Replacing the Base Unit
Replacing the Battery

PE80024

Memory cartridge accessed from the front

Replacing the Base Unit

The memory cartridge is easily accessible and can be removed from the front of Sepam™. It reduces the duration of maintenance operations.

Perform the following steps when a base unit fails:

1 Switch off Sepam™ and unplug connectors.
2 Remove the memory cartridge.
3 Replace the faulty base unit with a replacement unit (no memory cartridge).
4 Put the memory cartridge in the new base unit
5 Plug in the connectors.
6 Switch Sepam™ on again.

If there are no compatibility problems (see page 147), Sepam™ should operate with all its standard and customized functions without reloading any protection and parameter settings.

Replacing the Battery

Characteristics

Single use 1/2AA format 3.6 V, 0.8 Ah lithium battery, such as models:

- SAFT model LS14250
- SONNENSCHEIN model SL-350/S

Battery Recycling or Disposal

Refer to Environmental Protection Agency Solid Waste And Emergency Response (5306W) EPA530-K-97-009 November 1997 for directions and guidelines for recycling and disposal of batteries.

Replacing the Battery

1 Lift off the protective battery cover after removing both fixing screws.
2 Change the battery, being sure to use the correct type and polarity.
3 Replace the protective battery cover and both fixing screws.
4 Recycle the used battery.

Note : *The battery can be replaced with Sepam™ energized.*

Note : *For technical support, contact (615) 287-3400 or go to www.powerlogic.com*

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Contents

Ground Fault Current Measuring **152**
3-Wire Power System 152
4-Wire Power System 153

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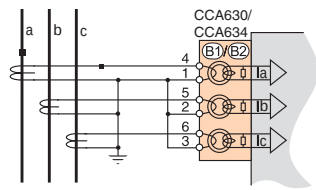
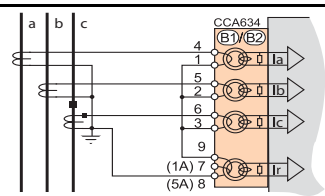
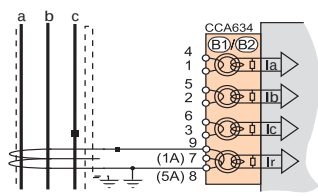
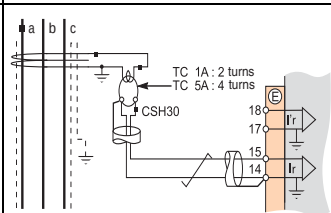
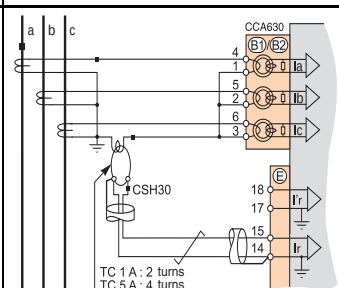
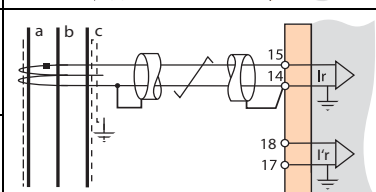
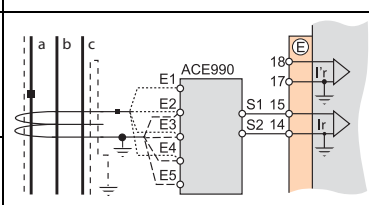
Ground Fault Current Measuring
3-Wire Power System

Method Number	Measurement Method	Measurement Range	Setting Range	Core Bal. CT	Connections	In (Source) Setting	Rating (Inr)
1A (CT and LPCT)	Internal Phase Current Summation	0.01 to 40 Inr (minimum 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	None		"None"	In of phase CTs
2A	Ext. sum of 3 standard 1A or 5A CT with CCA634 conn.	0.01 to 40 Inr (minimum 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	None		5A CT (or 1A) CSH30/ CCA634	In phase CTs
3A	Std 1A or 5A Zero Sequence CT with CCA634 conn.	0.01 to 20 Inr (minimum 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	Standard 1A or 5A Zero Sequence		5A CT (or 1A) CSH30/ CCA634	Inr Zero Sequence CT
4A	Std 1A or 5A Zero Sequence CT w/ CSH30 Aux CT	0.01 to 20 Inr (minimum 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	Standard 1A or 5A Zero Sequence		5A CT (or 1A) CSH30/ CCA634	Inr Zero Sequence CT
5A*	External sum of 3 Std 1A or 5A CT w/ CSH30 Aux CT	0.01 to 40 Inr (minimum 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	CSH30		5A CT (or 1A) CSH30/ CCA634	In Phase CTs
6A*	Specific CSH Zero Sequence CT on 2A Input Rating	0.01 to 40 Inr	DT=0.01 to 30A IDMT=0.1 to 2A	CSH120 CSH200		CSH120/200 0.2A rating	2A
7A	Specific CSH Zero Sequence CT on 20A Input Rating	0.02 to 400 Inr	DT=0.2 to 300A IDMT=0.2 to 20A	CSH120 CSH200		CSH120/200	20A
8A	High Ratio 1A or 5A Zero Sequence CT w/ACE990 Aux CT	0.01 to 20 Inr (minimum 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	High Ratio 1A or 5A Zero Sequence		"ACE990 Range 1" [k<0.05] or "Range 2" [k>0.l05]	k times number of turns zero sequence CT
			** min. setting = 100 mA except methods 6, 7				

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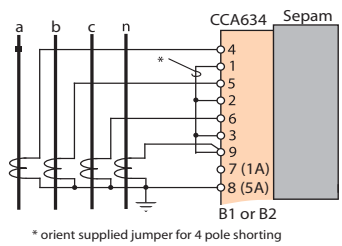
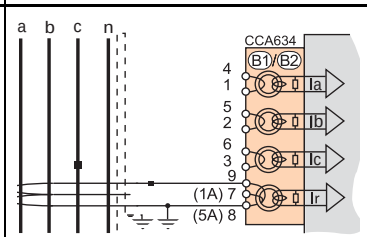
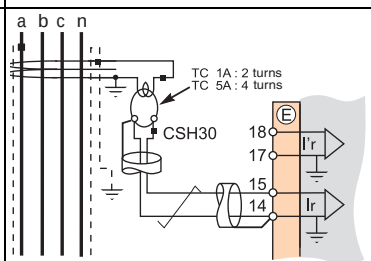
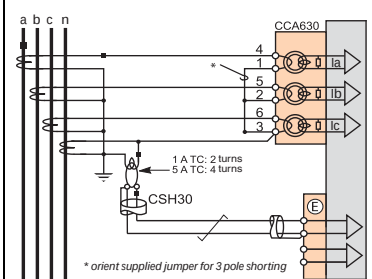
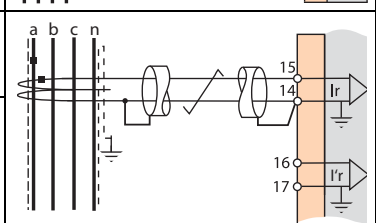
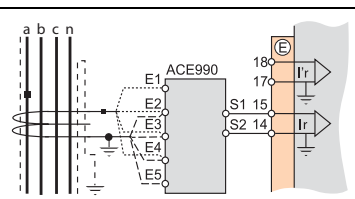
Ground Fault Current Measuring
4-Wire Power System

Method Number	Measurement Method	Measurement Rangs	Setting Range	Core Bal. CT	Connections	In (Source) Setting	Rating (Inr)
2B	Ext. sum of 4 Std. 1A or 5A CT w/CCA634 conn.	0.01 to 40 Inr (min. 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	none		"5A CT [or 1A] (CSH30/ CCA634)"	In Phase CTs
3B	Std. 1A or 5A Zero Sequence CT w/CCA634 conn.	0.01 to 20 Inr (min. 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	Std. 1A		"5A CT [or 1A] (CSH30/ CCA634)"	Inr Core Bal. CT
4B	Std. 1A or 5A Zero Sequence CT w/CSH30 Aux CT	0.01 to 20 Inr (min. 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	Std. 1A or 5A Core Bal. CT +CSH30		"5A CT [or 1A] (CSH30/ CCA634)"	Inr Core Bal. CT
5B	Ext. sum of 4 Std. 1A or 5A CT w/CSH30 Aux CT	0.01 to 40 Inr (min. 100 mA)	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	CSH 30		"5A CT [or 1A] (CSH30/ CCA634)"	In Phase CTs
6B*	Specific CSH Zero Sequence CT on 2A Input Rating	0.1 to 40A	DT=0.1 to 30A IDMT=0.1 to 2A	CSH120 CSH 200		"CSH120/200 2A rating"	2A
7B (Sensitive)	Specific CSH Zero Sequence CT on 20A Input Rating	0.2 to 400A	DT=0.2 to 300A IDMT=0.2 to 20A	CSH120 CSH200		"CSH120/200 20A rating"	20A
8B	High Ratio 1A or 5A Zero Sequence CT w/ACE990 Aux CT	0.1 to 20 Inr	DT=0.01 to 15 Inr IDMT=0.01 to 1.0 Inr	High Ratio 1A or 5A Core Bal. CT +ACE990 Aux CT		"ACE990 Range 1" [k<0.05] or "Range 2" [k>0.l05]	k times number of turns zero sequence CT
			** min setting = 100 mA except for methods 6, 7				

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